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THE PHYSIOLOGY OF WEEPING

BY

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THE WILLIAM MACKENZIE MEMORIAL LECTURE,
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WILLIAM MACKENZIE, to do honour to whose memory we are gathered together here to-day, wrote two books, one on the Physiology of Vision and the other on Diseases of the Eye, thereby showing that he recognized the necessity of a study of the former in dealing with the latter; or in other words that pathology is perverted physiology, and that correct pathology is the keystone to treatment.

I need, therefore, offer no apology in taking as the basis of this address, which you have so kindly invited me to give in his memory, a physiological phenomenon, and endeavouring to draw from its investigation some suggestions to guide us in our clinical work.

Meeting of Darwin, Bowman and Donders

In the autumn of 1869 Sir William Bowman took Professor Donders to visit Darwin in his country residence at Down. The agreeable impressions awakened by this memorable meeting of these three savants continued for long afterwards, and is referred to in the subsequent writings of each of them. They had many subjects of mutual interest, but that which was uppermost in Darwin's mind at the time of this meeting was the expression of the emotions, for his book on which he was then engaged in collecting evidence. The subject which he discussed with his two visitors was the physiology

of weeping. Why, he asked them, do infants when screaming keep their eyes firmly closed? That this is so he proved by having a series of instantaneous photographs taken of them when crying, which are reproduced in his book. Darwin[1] pointed out that the observation of this phenomenon had previously attracted the attention of Sir Charles Bell,[2] and he asked Bowman's and Donders' opinion of the following explanation which Sir Charles Bell gave of it.

Sir Charles Bell's explanation of the firm closure of the eyelids during acts of violent expiration

"During every violent act of expiration, whether hearty laughter, weeping, coughing or sneezing, the eyeball is firmly compressed by the fibres of the orbicularis; and this is a provision for supporting and defending the vascular system of the interior of the eye from a retrograde impulse communicated to the blood at that time. When we contract the chest and expel the air, there is a retardation of the blood in the veins of the neck and head; and in the more powerful acts of expulsion, the blood not only distends the vessels, but is even regurgitated into the minute branches. Were the eye not properly compressed at that time, and a resistance given to the shock, irreparable injury might be inflicted on the delicate textures of the interior of the eye." He further added, "If we separate the eyelids of a child to examine the eye while it cries and struggles with passion, by taking off the natural support to the vascular system of the eye, and means of guarding it against the rush of blood then occurring, the conjunctiva becomes suddenly filled with blood, and the eyelids everted."

Donders, at Darwin's request, agreed to investigate experimentally the influence of the action of the eyelids in connection with determination of blood to the eyes in expiratory efforts.

He published an account of these experiments in the "Nederland. Archiv vor Genees en Naturkunde" for 1870; a translation of the article into English by Dr. W. D. Moore appeared in Beale's "Archives of Medicine" in the same year. Both this article and Darwin's chapter on weeping in his book on "Expression of the Emotions" raise many points of ophthalmic interest deserving of further discussion.

Darwin's explanation of the origin of weeping as an expression of the emotions

Darwin sums up his views on weeping as follows:—

"Weeping is probably the result of some such chain of events as follows. Children, when wanting food or suffering in any way, cry out loudly like the young of most other animals, partly as a call to their parents for aid, and partly from any great exertion serving as

a relief. Prolonged screaming inevitably leads to the gorging of the blood-vessels of the eye; and this will have led, at first consciously and at last habitually, to the constriction of the muscles round the eyes in order to protect them. At the same time the spasmodic pressure on the surface of the eye, and the distension of the vessels within the eye, without necessarily entailing any conscious sensation, will have affected, through reflex action, the lacrymal glands. Finally, through the three principles of nerve-force readily passing along accustomed channels of association, which is so widely extended in its power, and of certain actions being more under the control of the will than others, it has come to pass that suffering readily causes the secretion of tears, without being necessarily accompanied by other action."

As Darwin points out the primary function of the secretion of tears, so far as the eyes are concerned, is to lubricate their surface. Another equally important function is to wash away particles of foreign substance which may get into the eyes. This latter function is a reflex action, the afferent impulse being due to a stimulation of the nerve fibres at the surface of the cornea; a form of impulse which may be excited by firm pressure on the cornea by the margins of the lids as by the presence of a foreign body.

Entoptic evidence of the squeegee action of the lid margins in man

The squeegee action of the lid margins on the surface of the cornea in man is well demonstrated by a method of entoptic examination devised by the late Dr. George Bull.[4] He allowed the light from a small candle flame five metres distant to be thrown in circles of diffusion upon the retina by a convex lens of about five centimetres focus held within two centimetres of the eye. The field seen by this method of examination is circular, more or less uniformly granular, and limited by a dark shadow of the iris. By the passage of the eyelids over the front of the eye two different sorts of bright bands bounded by darkened areas may be produced in the field, varying in appearance according to the amount of pressure exerted by the lid margins on the cornea. When the pressure is slight, as in winking, the bright bands are due to the curvature of the lubricating fluid which the eyelids push before them, they advance and recede with the movements of the eyelids, and a single sweep of the lids over the whole cornea, as in natural winking, instantly effaces them. When strong enduring pressure of the tarsal edge of the lid is made against the cornea, in what Bull speaks of as *clingement* (a French word for which he says there is no English equivalent), more persistent bright bands, which are not obliterated but made brighter by winking, are produced due to a depression formed in the surface epithelium.

Reflex lacrymal secretion precedes psychical weeping

As is well known infants do not weep or shed tears until they are several weeks old. Darwin found from observations which he made or had made for him, that the time at which free weeping commences is very variable; in one case when only 20 days old and in another not until the age of 104 days. He remarks:—"This circumstance is not exclusively due to the lacrymal glands being as yet incapable of secreting tears. I first noticed this fact from having accidentally brushed with the cuff of my coat the open eye of one of my infants, when 77 days old, causing the eye to water freely; and though the child screamed violently, the other eye remained dry, or was only slightly suffused with tears." The tears did not run over the eyelids and roll down the cheeks of this child until it was 139 days old.

This observation of Darwin's, that the reflex secretion of tears may be excited in infants before psychical weeping has developed is confirmed by Axenfeld's[5] histological examination of new-born infants' lacrymal glands. He found the secreting cells of such glands, their blood-vessels, and their nerves all well formed. At one time he thought the absence of adenoid interstitial tissue might account for the absence of secretion, but at a later date said this could not be the case, for this adenoid tissue steadily increases in old age, whilst the gland itself slowly atrophies. Besides many glands have none of this interstitial tissue, *e.g.*, the liver.

A differentiation between the secretion of fluid by the lacrymal gland as a reflex act excited by irritation of the surface of the eye, from that produced by a psychical stimulus as in weeping, is not only of physiological interest but also of clinical importance.

Lysozyme in the lacrymal secretion and its protective influence

The observations of Alexander Fleming[6] in 1922, and of Frederick Ridley[7] in 1928, have shown that the lacrymal secretion contains an enzyme, termed lysozyme, which is able to destroy not only the non-pathogenic bacteria, but also most of the organisms pathogenic to man and animals.

In his "Arris and Gale Lecture" Fleming said: "The great concentration of lysozyme in the tears is very striking . . . . it is clear that some cells in the lacrymal gland are capable of elaborating lysozyme very rapidly in high concentration, or of effecting an enormous concentration of the lysozyme which they might obtain from the blood fluids."

It has been suggested that as new born infants do not weep, therefore their conjunctiva is at that time unprotected by this antibacterial lysozyme. As, however, the lacrymal glands are well

developed and capable of secreting in response to irritation at birth, such reasoning must be fallacious. On the other hand I would suggest that the immunity of infants from ophthalmia neonatorum in whom Credé's treatment, or one of its substitutes has been employed at birth, is more likely due to the antibacterial lysozyme in the lacrymal secretion, an outpouring of which the chemical irritant excites, than to any germicidal property in the collyrium employed, which must quickly lose its potency by dilution.

It is also possible that the remedial effects of chemical irritants in other conjunctival affections may, likewise, be due to the lysozyme content in the outpouring secretion which they excite.

Psychical weeping phylogenetically and ontogenetically late in development

Darwin goes on to say, "a habit like weeping must have been acquired since the period when man branched off from the common progenitor of the genus *Homo* and of the non-weeping anthropomorphous apes." In other words, weeping, which is a flow of tears from a psychical stimulus is both phylogenetically and ontogenetically late in development. It has arisen in human infants as a purposive action to attract attention with the object of eliciting aid and sympathy. As age advances, and an independence of sympathetic aid becomes established, so this means of eliciting it becomes controlled or inhibited, more especially in the male sex than in the female, which latter being physically the weaker has in the past felt less assured of its independence. Circumstances of emotional stress, however, from time to time arise, such as some overbearing calamity or sense of failure either to oneself or to some relative or friend, when this power of control or inhibition is overmastered and the old method of eliciting sympathy of childhood again manifests itself. A sense of relief is obtained by ceasing to exert control, and allows unrestrained weeping to take place as an outlet for nervous energy, though utterly ineffectual in its primary intent.

Comparison of lacrymal and salivary secretion, both of which may be "conditioned reflexes"

A comparison may aptly be made between the mechanism for the secretion of the salivary glands and that for the lacrymal glands. Primarily the secretion of the salivary glands is excited by an afferent impulse set up from contact of food with the mucous membrane of the mouth, just as the lacrymal secretion is primarily set up by an afferent impulse from contact of a foreign substance with the conjunctiva. Secondarily salivary secretion has come to be excited by a psychic influence, such as the thought of food, which

makes the mouth water. The lacrymal secretion has likewise come to be excited by a psychic influence such as sorrowful thoughts.

It has been shown by Pavlov that in dogs, if at the time food is presented to them, a bell is rung, and the experiment repeated a sufficient number of times, what he calls a "conditioned reflex" may be established so that on hearing the bell in the absence of food salivation is stimulated. Under certain conditions a similar "conditioned reflex" may arise in connection with the lacrymal secretion, weeping taking place apart from any cause for grief. Thus Darwin says that "Dr. J. Crichton Browne (now Sir James) informed him, that nothing is more characteristic of simple melancholia, even in the male sex, than a tendency to weep on the slightest occasions, or from no cause. They also weep disproportionately on the occurrence of any real cause of grief. The length of time during which some patients weep is astonishing, as well as the amount of tears which they shed. One melancholic girl wept for a whole day, and afterwards confessed to Dr. Browne that it was because she remembered that she had once shaved off her eyebrows to promote their growth. Many patients in the asylum sit for a long time rocking themselves backwards and forwards, and if spoken to, they stop their movements, purse up their eyes, depress the corners of the mouth, and burst out crying. In some of these cases, the being spoken to or kindly greeted appears to suggest some fanciful and sorrowful notion; but in other cases an effort of any kind excites weeping independently of any sorrowful idea."

Do animals weep?

To weep has aptly been defined as to express grief by shedding tears. If we accept this definition then the secretion of tears as a reflex act from stimulation of the surface of the eye or of the mucous membrane of the nose—or from any direct stimulus of the efferent nerves proceeding to the lacrymal glands—is not included under the term weeping, no matter the amount of the secretion, and I think it is very doubtful if any animal other than man really weeps. Many of the accounts which have been given of weeping in animals are either myths or travellers' tales which have not received adequate verification.

Amongst the myths we have the ancient one of the crocodile which was said to weep either to allure a man for the purpose of devouring him, or whilst devouring him. Lindsay Johnson[8] says that he squeezed the juice of an onion mixed with common salt into the eyes of four species, but found that it had no effect on their moisture beyond the slight normal secretion. Tears shed hypocritically as a pretence of sorrow are still spoken of as "crocodile's tears."

Deer have also been credited with weeping when they shed their horns. Thus Shakespeare makes Hamlet exclaim, when the King

stops the play which was designed to expose his crime:—"Why, let the stricken deer go weep." Another sixteenth century author, Webster, writes:—"Here is a stag, my Lord, hath shed his horns, and for the loss of them the poor beast weeps." The reason for attributing sorrow to deer on the loss of their horns would appear to have arisen from them drooping their heads after they have shed the horns, more especially when passing under trees, being for the time unmindful of their loss and the lack of necessity for so lowering their heads.

Though Darwin devoted considerable attention to the expression of the emotions in domestic animals such as dogs, cats and horses, he makes no mention of ever having observed them weep as an expression of grief. He does, however, refer to some hearsay evidence as to elephants weeping. He quotes the following description which Sir E. Tennent[9] gives of captured elephants which he saw bound in Ceylon—some "lay motionless on the ground, with no other indication of suffering than the tears which suffused their eyes and flowed incessantly." Speaking of another elephant he says, "When overpowered and made fast, his grief was most affecting; his violence sank to utter prostration, and he lay on the ground, uttering choking cries, with tears trickling down his cheeks." Darwin failed to obtain any confirmatory evidence as to captured elephants weeping from those to whom he applied to make special observations on the matter for him. The Rev. Mr. Glenie wrote to him: "Captured elephants when irritated screamed violently; but it is remarkable that they never when thus screaming *contracted the muscles around the eyes. Nor did they shed tears;* and the native hunters asserted that they had never observed elephants weeping."

In a foot-note in the second edition of his book Darwin also quotes Gordon Cumming's[10] statement concerning a large bull elephant which he lamed, without at first killing, by a shot in the shoulder. Cumming then made some experiments to find a vulnerable point, and fired several bullets at different parts of the animal's enormous skull, "which did not affect him in the slightest." Finally after having received a further nine shots behind the shoulder, Cumming says: "large tears now trickled from his eyes, which he slowly shut and opened; falling on his side he expired." In this case I think the secretion of the lacrymal gland was more likely to have been excited by some stimulus of one of the efferent nerves from one of the numerous shots fired into its head than by an emotion of grief.

Darwin also quotes the statement of the keeper of the Indian elephants in the Zoological Gardens to the effect that he had several times seen tears rolling down the face of the old female when distressed by the removal of the young ones. He himself

says he watched Indian elephants when the keeper had made them trumpet loudly and then observed their orbicularis muscle, both upper and lower, to contract strongly, but makes no mention of his having seen any secretion of tears to have overflowed.

In the issue of the *Illustrated London News*[11] for February 21, 1931, there were pictures and a description of the Australian Kola Bear, a marsupial animal that lives in trees, and for which Mr. Noel Burnett has recently acquired a forty acres of bush reserve in the West Pennant Hills near Sydney. In the description it was stated:—"That when molested or hurt it whimpers and cries piteously like a child; tears roll down its face, and it rubs its eyes with its forepaws." On reading this I wrote to Mr. Noel Burnett on the matter and received a most interesting and courteous letter in reply. In it he said:—"The statement that bears cry piteously, and that tears roll from their eyes when molested or hurt is not altogether mine . . . occasionally a female may be teased by a male, or we may have to take a female against her will, or administer some veterinary attention in which case the bear will certainly cry, but it is only a cry of fear and not of pain, and I have noticed no tears."

Robert M. Yerkes, the Professor of Psychobiology in Yale University, who has published his extensive original and historical researches connected with anthropoid life, in his book entitled "The Great Apes,"[12] writes:—"I have never seen anthropoids weep or laugh in quite the human sense of the term." Speaking of chimpanzees he says:—"That depression, grief, and sorrow, are occasionally manifested by the chimpanzee is beyond dispute. Definitely established also is the fact that weeping in the human sense does not occur. The typical approach to it is whining, moaning, or crying in the manner of a person in distress. Tears we have never observed, and in this we are confirmed by statements of Garner, Rothmann and Teuber, and Köhler."

In a letter he kindly wrote to me in response to some enquiries of mine on the matter, he says:—"I have often wondered why weeping with tears happens to be so peculiarly human. So far as I have observed or learned with assurance from reliable authorities, no other animal weeps." "Young anthropoid apes," he goes on to say, "frequently cry under certain circumstances which would induce like response in the human infant or child, but never in such instances even when the response is extreme have I seen tears."

It is interesting here also to note that some human beings, with perfectly normal eyes, never develop the capacity of weeping, *i.e.*, of shedding tears in response to an emotional stimulus. Only last month a lady of mature years came to me complaining that she had never been able to weep, and saying how much she envied other women who could find relief for their emotions in "a good cry."

Protective mechanisms for the surface of the eyes in mammals

Neither the three distinguished savants at their meeting in 1869, nor Darwin in his subsequent writings on the "Expression of the Emotions," seem to have taken into account the important part played in the protection of the surface of the eye by the nictitating membrane in air-breathing vertebrates below primates.

In many of the amphibia and mammals a powerful retractor bulbi muscle by drawing back the eyeball in the orbit causes this nictitating membrane to move over the surface of the cornea, between it and the eyelids. The eyeball is restored to its former position partly by the recoil of the elastic membrane, the "cornet," which fills the gap in the outer bony wall of the orbit, and partly by the contraction of the muscle of Gegenbauer which lines it.

The margins of the upper and lower eyelids in such animals do not come into contact with the cornea on closure of the eyelids as they do in primates, in whom the nictitating membrane is only represented by the vestigial semilunar fold, and in whom the retractor bulbi and protrusio bulbi muscles are either absent or likewise vestigial. There is, therefore, an anatomical reason which renders it unlikely that any animals other than primates really weep.

Development of the facial muscles in mammals, correlated with suction and the separation of the thoracic and abdominal cavities by the diaphragm

In the cold-blooded vertebrates the bony mask of the face is covered merely by skin, which is tightly stretched over it. It is in the warm blooded mammals that the facial muscles first commence to grow in between the skin and the bone. The following description of their formation is given by Dr. William K. Gregory[13] in his book entitled "Our Face from Fish to Man":—"Even in the most primitive of living mammals the hard bony mask of the face has already begun to sink beneath the surface, and a more or less pliable skin has been developed. But the most remarkable fact is that as the bony mask sank beneath the surface the "facial muscles," so characteristic of the mammals alone among vertebrates came into being. Where did they come from? In the reptiles the neck and throat are covered by a thin wide band of muscle called the primitive sphincter colli, which is activated by a branch of the seventh cranial nerve. In mammals this muscle, besides giving rise to the platysma muscle, has grown forward between the bony mask and the skin, along the sides and top of the face. As it grew forward over the cheek it sent out various subdivisions which either surrounded the eyes, or covered the forehead and cheeks, or surrounded the lips, or connected the lips with the cheeks, or were attached to the ears.

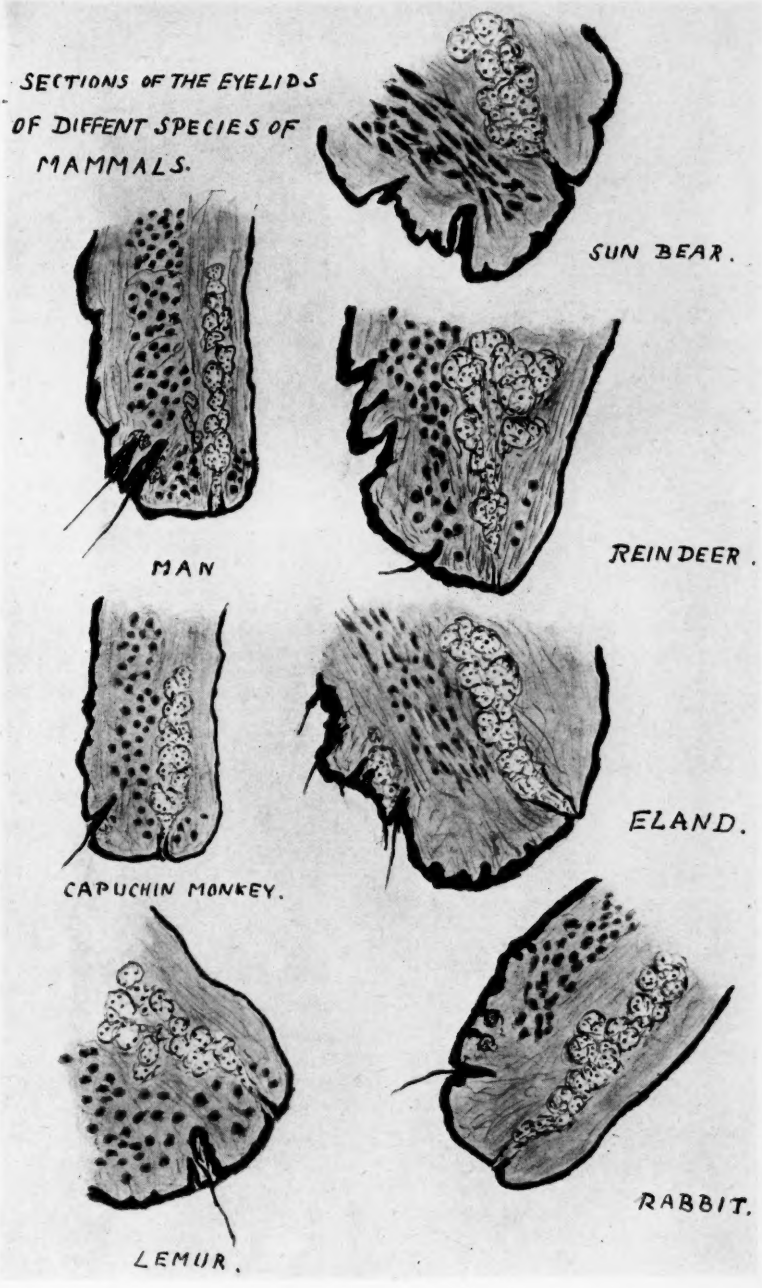
Whenever the muscle mass sent forth a new branch it also drew into this branch a twig from the main facial division of the seventh nerve. Thus what are called the mimetic or facial muscles of mammals arose by the forward migration and subdivision of a muscle formerly covering the neck. For this doctrine the anatomists Ruge and Huber have brought forward the most detailed and convincing evidence."

This exclusive characteristic of mammals, the development of the facial muscles, may be correlated with their two other exclusive characteristics, *viz.*, the development of mammæ, which has given them their name; and the development of a diaphragm separating the thoracic and abdominal cavities, which converts the former into a species of bellows for the purposes of respiration.

The importance of the development of muscles around the mouth in mammals for purposes of suction is obvious. A like importance may, I suggest, be attached to the development of muscles around the eyes, for the protection of their blood vessels in connection with the contraction of the diaphragm, in violent expiratory efforts from the chest, in expulsatory efforts from the abdomen, and in certain other violent muscular exertions.

In speaking of the contraction of the muscles around the eyes, Darwin writes:—"It is not necessary, in order to lead to the contraction of these muscles, that air should actually be expelled from the chest; it suffices that the muscles of the chest and abdomen should contract with great force, whilst by closure of the glottis no air escapes. In violent vomiting or retching the diaphragm is made to descend by the chest being filled with air; it is then held in this position by the closure of the glottis, as well as by contraction of its own fibres. The abdominal muscles now contract strongly upon the stomach, its proper muscles likewise contracting, and the contents are thus ejected. During each effort of vomiting the head becomes greatly congested, so that the features are red and swollen, and the large veins of the face and temples visibly dilated. At the same time, as I know from observation, the muscles round the eyes are strongly contracted. This is likewise the case when the abdominal muscles act downwards with unusual force in expelling the contents of the intestinal canal."

That able anatomist and sculptor, Dr. Tait McKenzie,[14] Professor of Physical Education at the University of Pennsylvania, who has not only made a study of the facial expression of violent effort, breathlessness and fatigue, but has also depicted it in masks modelled by himself, has shown that in violent muscular efforts of short duration, such as sprinting for a 100 yards race or for throwing heavy weights, in which the diaphragm is thrown into action with the chest distended and the glottis closed, the orbicularis muscles around the eyes are contracted as fully as possible. Thus he



Showing varying degrees of development of the subtarsalis muscle or ciliary muscle of Riolan.

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writes:—"At the start of a hundred yard dash the runner catches his breath, and usually holds it during the entire race if closely pressed. During this time the body is under stress of the most violent action, the great muscle masses of the legs are in powerful alternate contraction and the torso is pulled and compressed by the vigorous action of the arms. The shutting of the glottis gives a more solid *point d'appui* for the muscles of the arms and shoulders, but it increases enormously the pressure on the heart and lungs. This increase in blood-pressure shows in the purple and swollen face and the red suffused eyes, in the lips retracted from the clenched teeth and the muscles of the neck fixed in contraction. This peculiar characteristic expression is also seen in jumpers, hurdlers, hammer-throwers, and football players. It indicates the acme of any violent effort . . . . . Undoubtedly the runner would shut his eyes if he could, and the hammer-thrower occasionally does so at the moment of the greatest effort; but the runner must keep his course, and so the eye-openings are merely narrowed as much as possible."

For the protection of the surface of the eyes in man and primates the squeegee action of the tarsal margins of the upper and lower eyelids, and the secretions of the lacrymal glands and conjunctiva, have replaced the nictitating membrane, the retractor bulbi and protrusio bulbi muscles, and the secretion of the gland of Harder of other vertebrata.

The muscle of Riolan in man and other mammals

The close apposition of the lid margins to the cornea which may, as already mentioned, cause depressions in its surface epithelium, is brought about by the contraction of that portion of the orbicularis muscle situated within the line of the roots of the eyelashes and around the ducts of the Meibomian glands, the so-called subtarsalis muscle or ciliary muscle of Riolan.

Through the courtesy of Sir Peter Chalmers Mitchell and the pathologist, Col. A. E. Hamerton, of the Zoological Society, I have been able to have made and examine microscopical sections of the eyelids of a variety of different species of mammals; and have found in them very varying degrees in the development of the subtarsalis muscle of Riolan (*vide* Plate.) In none of them is it such a definitely separate and distinct group of fibres as in man. Its degree of development may be closely correlated with the presence or absence of an active nictitating membrane. In the only primate I have examined other than man, a brown Capuchin monkey *(Cebus Fatuellas)* it approached nearest to that in man. In a red frontal lemur *(Lemur fulvus rufifrons)* the orbicularis muscle extended to the border of the lid superficially, but only a few fibres were present on the tarsal surface of the ducts of the Meibomian

glands. The same applies to the reindeer *(Rangifer Tarandus)*. In the sun bear *(Ursus Malaganus)* and the eland (*Taurotragus Oryx*), though the orbicularis muscle is well developed no subtarsalis muscle is present. This set of muscle fibres is also completely absent in the eyelids of rats and rabbits.

In association with this late phylogenetic evolution of the subtarsalis muscle of Riolan, it is interesting to note its late appearance in the human embryo. Miss Mann[15] says:—"Riolan's muscle cannot be recognized as separate from the orbicularis muscle mass until 62 mm., by which time the lid margins are adherent and the rudiments of the cilia apparent."

Donders' experiments on the effects of expiratory efforts on the extra-ocular, intra-ocular and retro-ocular blood vessels

Donders' paper, written at Darwin's request, "On the action of the eyelids in determination of blood from expiratory efforts," is full of interesting observations and experiments. He first confirms Sir Charles Bell's observation as to the contraction of the orbicularis muscle during violent expiratory efforts, pointing out that at such times two factors tend to increase the blood pressure and distend the external, the intra-ocular, and the retro-ocular blood vessels; first the direct increase of pressure in the arteries, and secondly the delay in the return of the flow of blood through the veins. Fluctuations which show in a sphygmogram are spoken of as respiratory undulations.

Like Sir Charles Bell, Donders found that the dilatation of the external vessels on the surface of the eye, during violent respiratory efforts, can be readily observed by lifting the eyelid away from the globe at such times.

As to the influence of such efforts on the intra-ocular blood vessels Donders found evidence by observing the pulsations of the retinal veins on the optic disc. He says:—"In the place where these exhibit the systolic movements, in voluntary expiratory effort after tolerably deep inspiration, they become greatly distended, and remain distended, so long as expiratory pressure lasts, on the subsequent inspiration they suddenly collapse, and at first in a still constricted condition, rapidly again exhibit the phenomenon of the pulsus venosus."

This observation is confirmed by Duke-Elder[16] who writes:—"Whenever the outflow from the veins is sufficiently obstructed the venous pulse will not occur, no matter what the pressure relations are. This is seen experimentally in the abolition of a pulse in any condition of venous engorgement as by prolonged expiration (Trigt, 1853: Donders, 1855), on raising the arms above the head (Manz, 1874; Laquer, 1877), on compressing the jugulars or the thorax (Helfriech, 1882), or on kinking the vein by rotating the eyes to the side (Graves.)"

As regards the influence produced on the intra-ocular circulation by strong contraction of the orbicularis muscle, Donders quoted the effects seen ophthalmoscopically and entoptically on the retinal circulation by pressure on the eyeball. He said how he had observed ophthalmoscopically that the moment pressure kept up for some time on the globe was relaxed all the vessels of the retina (and at the same time the vessels of the choroid) became suddenly distended. The same sudden distension he said could be seen entoptically in connection with the shadows of the retinal vessels in Purkinje's experiment.

Donders describes his method of investigating the effects of respiratory movements, more especially powerful expiratory efforts, on the retro-bulbar venous system in the following manner:— "The head was fixed and the eye directed to a point so that the axis of the cornea made a right angle with the axis of a Helmholtz ophthalmometer which was employed in the investigation. Care was thus taken that the cornea was seen exactly in profile. Two short black hairs were now, in a vertical direction and parallel to one another, stuck on a level with the cornea against the lateral wall of the root of the nose, so that they were seen together with the boundary of the cornea, and the distance from the latter to these hairs could be accurately measured by doubling the ophthalmometer images. Movements of 0·02 mm. should in this manner be certainly recognizable;" yet he did not succeed in ordinary respiration in demonstrating any movement.

"It was otherwise, he says, when the respiration was increased or laboured, and especially when a powerful expiratory effort was maintained for some time. In the first case, at least some expiratory movement of the eyeball is in most men perceptible, and in the second we see, while the face becomes red and swollen, the eyeball distinctly advances. In young men, this movement appeared to be less than at a somewhat advanced time of life. As the maximum I found in a man aged 42 years, 1·45 mm., in five cases, on an average, 1·1 mm. It is developed very gradually in eight or ten seconds to its maximum, and it requires from three to four seconds to disappear again entirely. This can be attributed to nothing else than dilatation of the veins of the orbit. There is, I think, no doubt that pressure of the eyelids is capable of preventing this dilatation."

Advance of the eyeball on voluntary widening of the palpebral aperture and its recession on nictitation

In connection with his observations with the ophthalmometer as to the position of the eyeball in the orbit another noteworthy phenomenon attracted Donders' attention. He found that on voluntary widening the palpebral aperture by raising the upper

eyelid the eyeball advanced, and that at each nictitation the eyeball receded in the orbit. He gives a table showing the mean of many measurements in millimetres of the recession of the globe on constriction of the palpebral aperture, and of its advance on the dilatation of the aperture. The total displacement varied from 0·78 to 1·46 mm.

He found that passive raising of the eyelid, as by a spatula, had no influence on the position of the eye, concluding, therefore, that its advance was the result of muscular contraction. He assumed that of the levator palpebrarum, apparently not taking into consideration the possible influence of the contraction of Müller's unstriated muscle fibres in the eyelids, and of similar fibres, also named after Müller, connected with the orbital periosteum in the inferior orbital fissure, both of which sets of fibres receive their nerve supply from the cervical sympathetic. The unstriated muscle fibres which form part of the orbital aponeurosis are the vestigial remains of Gegenbauer's orbital muscle or the protrusio bulbi muscle of the lower mammals. Their presence in man was demonstrated by Müller in 1858, by Sir William Turner in 1862, and again by Sappey in 1868. It is known that paralysis of the cervical sympathetic nerve gives rise not only to slight drooping of the upper eyelid, and narrowing of the palpebral fissure, but also to some recession of the eyeball in the orbit. Macallum and Cornell[17] found that when a dog's head is removed from the body, and the blood allowed to drain away, stimulation of the cervical sympathetic results in an exophthalmos as pronounced as any produced in the living dog, thus demonstrating that it was brought about not by vascular distension, but by contraction of the musculus orbitalis of Müller. Jonnesco[18] by employing strong stimulation of the sympathetic in man reports that he produced definite protrusion of the eyeball. It would, therefore, seem most probable that the phenomenon observed by Donders in normal conditions, of widening of the palpebral aperture being accompanied by slight proptosis, is due to the contraction of the unstriated muscle fibres of Müller in the eyelid and in the orbit, both of which are supplied by the cervical sympathetic nerve.

The proptosis and retraction of the upper eyelid with widening of the palpebral fissure which are so marked in Graves's disease are also, I suggest, due to over stimulation of these same sets of unstriated muscle fibres which may under such conditions become hypertrophied.

In summing up the results of his experiments and observations Donders says:—"We have satisfied ourselves that the external vessels of the eye, as well as the intra-ocular and retro-ocular, are dilated by increased expiratory pressure. We have seen that the eyelids in closing limit or entirely remove this dilatation, partly

by pressure, partly perhaps by a certain associated action. We have remarked, that on each increase of expiratory pressure the eyelids are closed, or are at least inclined to close. The conclusion is therefore evident, that by closing of the eyelids the injurious effect of an overflow of blood is warded off."

Besides the support which the ocular blood vessels receive from closure of the eyelids, the intra-ocular vessels are protected from over distension by the tense condition of the eyeball and the elasticity of its membranes. The retro-ocular vessels in the orbit have also the additional protection of their free anastomoses with the facial veins, the absence of valves in them allowing such anastomoses to be readily opened up in the event of any delayed flow of blood in the normal direction into the cavernous sinus.

So effectual are these protections under ordinary conditions, reinforced as we have seen they are at times by pressure on the eyeball from firm closure of the eyelids, that Donders was obliged to admit that he had found but little evidence of essential injury to the eyes occurring from want of support in expiratory efforts. Under exceptional conditions haemorrhages from all three sets of such vessels have, however, been recorded. These exceptional conditions may be classed as follows :—

(*a*) Dyspnoea and asphyxia resulting from compression of the chest or neck from without.

(*b*) Violent expiratory efforts from contraction of the diaphragm, after a deep inspiration followed by closure of the glottis.

(*c*) Violent expulsive abdominal efforts from contraction of the diaphragm under similar conditions.

(*d*) Undue weakness of the walls of the ocular blood vessels in association with (*b*) and (*c*).

(*e*) Lowered intra-ocular pressure in association with (*b*) and (*c*).

Ocular haemorrhages following dyspnoea from compression of the chest or neck from without

Max Knies[19] says :—" In acute suffocation the pupil is generally, though not always narrow, and haemorrhages, often only punctate occur into the conjunctiva and retina. The latter are often not seen until the autopsy. The haemorrhages also often occur beneath the integument of the lids and are found occasionally in all the vascular parts of the eye and its vicinity (Schlemm's canal, Petit's canal, etc.). In chronic suffocation, in which similar haemorrhages may finally be produced, the retinal vessels, particularly the veins, appear with the ophthalmoscope to be unusually dark, often almost black as the result of overloading the blood with carbonic acid."

Webster Fox[20] writes :—" Haemorrhagic foci appear especially in the conjunctiva, in those killed by asphyxia, hanging and strangulation, their importance being recognised from the standpoint

of legal medicine. Circulatory disturbances also cause retinal haemorrhages, as in pulmonary emphysema, emboli of the pulmonary artery, and cyanosis consecutive to respiratory troubles where there is simultaneous formation of haemorrhagic foci in the retina and in the conjunctiva. This is especially observed in cases where death has been preceded by symptoms of suffocation."

Arnold Knapp[21] says:—"Conditions which produce venous stasis, even if sudden and of high degree, rarely produce retinal haemorrhages. After severe injuries to the body, in which the thorax or the abdomen are compressed, it is frequent to find the head, neck and chest and the visible mucous membranes dark blue and covered with small haemorrhages. In a few cases haemorrhages have also been observed in the retina. Roenne has observed haemorrhages occurring in seven out of 60 cases. This rarity is explained by the protection which the retinal vessels derive from the ocular pressure. As a rule the retinal haemorrhages in these cases cause no visual disturbance and are rapidly absorbed."

Berrisford,[22] in 1921, wrote an article on the ocular symptoms in traumatic asphyxia or apnoea, in which he described the case of a man who was for eight minutes accidentally pinned under a two-ton tunnelling machine, and discussed those in other recorded cases of a similar class, in which the patients had been crushed in crowds. The eyes in Berrisford's case were proptosed, the ocular conjunctiva protruded through the palpebral fissure and had haemorrhages in it; where, however, the lids stood in contact with the eyeball the conjunctiva though congested was free from haemorrhages. The fundi showed dilatation and tortuosity of the retinal veins, and bluish-grey patches which were supposed to be due to oedematous swelling in the nerve fibre layer. They disappeared completely in eight weeks, and may, I suggest, quite likely have been similar in nature to patches of commotio retinae, and caused by subchoroidal haemorrhage.

Ocular haemorrhages from violent expiratory or abdominal expulsive efforts

In the violent expiratory or expulsive efforts occasioned by contraction of the diaphragm after a deep inspiration, as in coughing, sneezing, vomiting, straining at stool, and in the second stage of parturition, it is the external vessels of the eye which are most liable to rupture, giving rise to subconjunctival ecchymoses. Most writers of textbooks on eye diseases refer to such subconjunctival haemorrhages in connection with whooping cough.

Clement Lucas[23] in an article on "Ocular Ecchymosis" writes:—"Another cause of subconjunctival ecchymosis is any sudden violent arrest of respiration and circulation; such as occurs in

whooping cough, in severe vomiting and such as results from crushing blows upon the abdomen and thorax."

That an accessory cause to the occurrence of subconjunctival haemorrhages may be compression of the jugular veins in the neck by too tight a collar I know from personal experience. At one time I had a recurrence of such little haemorrhages in my own eyes which entirely ceased when I adopted the use of a collar of a larger size.

Rupture of the orbital vessels from such expiratory or expulsive efforts must be of exceedingly rare occurrence, some such cases have, however, been recorded. Max Knies refers to a case observed by Dépontot in which spontaneous luxation of the globe in front of the eyelids was observed as a result of sneezing, and says that he himself has observed it as the result of sneezing in Basedow's disease.

In connection with whooping cough Max Knies says:—"Orbital haemorrhages, unless extensive, are usually not noticed for several days, when the extravasated blood appears beneath the conjunctiva, in the eyelids and adjacent parts. Small haemorrhages are harmless; large ones, which are rare, produce exophthalmos." Mackenzie mentions having seen a girl of eight years of age with exophthalmos of the right eye, produced by "chin-cough." The eye was movable, and vision good. Her brother had been in the same state, but in him the eye retreated under cold applications.

Donders mentions a case of exophthalmos recorded by Dr. Gunning which he regarded as due to rupture of vessels in consequence of whooping cough.

Weakness of the vessel walls or lowered intra-ocular pressure as coincident changes

In the less violent expiratory efforts haemorrhage from congestion of the ocular vessels is most likely to occur where the vessel walls are brittle or where their surrounding elastic support has been decreased. Thus Max Knies writes:—"Sneezing, blowing the nose and coughing may give rise to haemorrhage in all vascular parts of the eye and its vicinity, most frequently in the conjunctiva, eyelids and retina. In such cases there are often coincident changes in the vessels particularly atheroma, and these naturally constitute a predisposing factor." In illustration of this I may here quote the following case which recently came under my own observation.

A medical man, aged 67 years, came to see me on March 25, 1929, stating that two months previously after sneezing violently whilst walking in the snow, he noticed a blood-coloured shadow in front of his left eye, which had since slowly become reduced in size. The vision in his R. eye was 6/6 partly and in his L. 6/18 two letters. His blood pressure he told me at the time his vision failed

was 195 to 200, but had since become reduced. I found on ophthalmoscopic examination, a large circular sub-hyaloid haemorrhage above the macula in his left eye, and two small haemorrhages in the retina below it. His retinal arteries were thickened and kinked the veins where they crossed them in the neighbourhood of the optic disc.

Most of us have probably had the painful experience of haemorrhage occurring in an eye which has had the elastic support to its vessels lowered by an operation for extraction of cataract or for the relief of glaucoma. Such painful incidents were far more frequent when those operations were performed under a general anaesthetic which was not uncommonly followed by retching or sickness. Indeed in those days a nurse used to be seated beside such patients as they recovered from the anaesthetic with instructions to place her hand over the operated eye, to give it additional support, should the patient retch or vomit.

The influence of violent expiratory efforts in glaucomatous eyes or in eyes predisposed to glaucoma

The contents of the eyeball may in some respects be compared to the contents of the cranial cavity. In infants in whom the fontanelles are still open, movements in the cranial contents, due to variations in blood pressure, are easily seen in connection with respiration, rising during expiration and falling during inspiration. Similarly it has been shown by several different experimenters, that when a manometer is connected with the fluids in the interior of the eye, movements will occur which not only synchronise with the pulse but also with respiration, and may be as distinct as the pulse and respiratory waves in an ordinary blood-pressure curve.

Under normal conditions, any rise in intra-ocular pressure which is occasioned by violent expiratory efforts will be readily compensated for by an increased escape of aqueous humour through the filtration channels at the angle of the anterior chamber. In conditions, however, where, as in advanced life, the walls of the blood-vessels have lost some of their former elasticity, and where the free passage of fluid through the normal safety valves is in any way impaired, the rise in intra-ocular pressure occasioned by prolonged expiratory efforts might aid in the further closure of the safety valves or the intensification of glaucomatous symptoms. That this is so seems to be borne out by clinical experience. It is generally recognized that conditions which disturb the circulation and tend to congest the venous system predispose to the production of glaucoma. Both Priestley Smith and Col. Elliot mention bronchitis and chronic constipation as common antecedents of glaucoma, and Fuchs speaks of its frequent occurrence in connection with influenza.

Firm closure of the eyelids under certain conditions as a preventive of ocular lesions

The investigation of a physiological phenomenon will often afford valuable suggestions as to the preventive treatment of pathological disturbances. So the investigation of the physiology of weeping, and why children when crying contract their orbicularis muscles, suggests measures which may be taken in the prevention of vascular disturbances occurring in connection with violent muscular exertions or expiratory efforts.

In cases of recurrent sub-conjunctival haemorrhage, advising patients to adopt the simple precaution of consciously firmly closing the eyelids when straining, coughing violently or sneezing, as an infant does unconsciously; and also seeing that their neckwear is not so tight as to press unduly on their jugular veins, will check such recurrences.

Similar advice to elderly patients who show signs of sclerosis of the retinal arteries and have increased blood pressure, will be likely to prevent intra-ocular haemorrhages fraught with more serious consequences.

When the natural surrounding elastic external support of the intra-ocular vessels is diminished, by the lowered tension of the eye-ball following an operation of extraction of cataract or for the relief of glaucoma, the advisability of giving extra external support by means of a pad and bandage becomes obvious. Such a practice is, I believe, almost universal in this country; on the continent, however, I know there was one surgeon who considered it as unnecessary and undesirable, arguing that the tying of an eye up after such operations tends to promote the accumulation of micro-organisms and their proliferation in the conjunctival sacs.

Patients suffering from glaucoma or a tendency to it should be advised to try and avoid anything likely to lead to prolonged or frequent expiratory efforts, such as attacks of bronchitis, of influenza, vomiting or constipation; and should such efforts be unavoidably incurred to keep their eyes firmly closed whilst they last. They should further be instructed to discard any article of clothing liable to retard the return of blood from the head by compression of their jugular veins.

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THE CONVERGENCE OF HUMAN BINOCULAR VISION

BY

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IN my work "Indications for the Kinetic Treatment of the Eyes,"[1] I have called the central kinetic factor of human binocular vision "Involuntary Convergence." In available literature I find convergence mentioned only as a voluntary movement.[2] But ***voluntary*** convergence is ***not*** the kinetic factor of binocular foveal-macular vision. Therefore, in order to make it clear that I dealt with the ***reflex*** motor-co-ordination and not with the other function—the willed movement—I called it Involuntary Convergence.

I trust that this long term will soon make place for convergence, pure and simple. "Voluntary convergence" is really a misconception of voluntary binocular adduction, a movement of considerable importance to make the two visual fields overlap, but it is not the convergence of ***bi-foveal vision.***

It appears that some serious confusion exists in the terms and definitions of binocular ophthalmology. One of the causes of this condition is, I consider, the overlapping of ophthalmological science with mechanics or optics on the one side (on account of the ocular media) and with psychology on the other side (on account of the visual fields in the cortex cerebri). This confusion obscures the outlook on the physiology of binocular vision.

Cantonnet complains that binocular vision is neglected[3] "mais qui s'occupe de la vision binoculaire?"

Some definitions in binocular ophthalmology are veritable stumbling blocks to the scientific layman. Recently, an eminent anthropologist remarked to me that he could make neither head nor tail of many of the ophthalmological terms. Our conversation was on the comparative anatomy of the skulls of man and the primates in connection with binocular movements.

Before going any further, therefore, I want to make clear what meaning I attach to some important terms.

Fusion

Fusion of the two ocular images is a psychological phenomenon. Experimental investigation has proved that there is no actual fusion, either in an optical or in a physiological sense.[4] The ophthalmologist, therefore, should avoid using the word fusion in the terms describing binocular movements. The terms fusion-range, fusion-movements, fusion-compulsion (*Fusions-zwang*), etc., wrongly suggest physiological relations. Not fusion but reflex-convergence —a measurable function and not a psychological phenomenon—is responsible for the bringing together of the two foveal images.

Convergence and Divergence

The motor-co-ordination of human binocular convergence is more than an optical or a mechanical movement; it is a ***functional*** one. Definitions should be clear on this point, but they are not.

Convergence is a ***visual*** binocular movement—a movement in connection with an ***object of vision*** for the biunial—or dual—eye. By this definition the well-known "convergent squint" and "strabismus convergens" are condemned as devoid of sense, a contradiction ***in adjecto***. In every squint necessarily one of the ocular axes ***deviates*** from the object of vision, consequently every squint is ***di***-vergence.

In ophthalmology a ***position*** of ***con***-vergence does not occur. Convergence is always movement[5] and always active movement, even when the dual eye is fixing an object.

A position of divergence is ***every*** binocular position where the two visual axes do ***not*** meet in an object of vision, ***e.g.***, the natural position of binocular rest—in sleep, in deep narcosis, probably even in staring.

The motor-co-ordination of divergence is not a ***visual*** movement; it is not even a function in ophthalmology, but it is either a relaxation of convergence, or a voluntary act of disturbing the convergence (in voluntary squint).

Centres for convergence have been found in the brain; one of considerable phylogenetic importance in the mid-brain.[6] But the quest for a centre of divergence has been in vain, so far.[7] It

will probably remain so, for could one expect to find a brain centre for the relaxation of the action of a function?

It must be borne in mind that, contrary to the confused common conception, the motor-co-ordinations of convergence, as well as of divergence, consist of the same component movements of the individual eyes. Both convergence and divergence can be composed of adductions or abductions or sursum- or deorsum-ductions or any possible combination of these. If, for instance, while looking at an object straight ahead I start squinting by voluntarily *ad*-ducing the eyes, then this should be called a movement of divergence just as well as when, by closing the eyes, I allow them to be *ab*-duced towards the position of rest.

The point is that convergence always is a ***visual*** movement and that divergence never is a visual movement.

Equally important is that every visual movement of the human binocular organ is convergence. The resulting motor-co-ordinations may—or may not—have other components—upwards, or downwards, to the right or to the left—as well, ***but the basic movement is convergence.*** Without convergence no binocular foveal single vision is possible, and this can be said of no other kinetic factor, of no other movement. This convergence is the obligatory factor of every visual binocular movement. It is, therefore, more than a function; it is the kinetic principle of binocular vision.

This Convergence as the Kinetic Principle of Binocular Vision

For a pair of eyes which have no fovea, a movement of convergence has no meaning. There are no visual axes that can converge. Such eyes may have the power of adduction which makes the two visual fields overlap more than in the primary position. This, however, should not be called convergence.

Only an eye possessing a fovea is equipped for distinct vision in one line. Such an eye is an organ which is physiologically equipped with the strong tendency to bring one single visual line into such a direction that a specialized central spot of the retina can—and must—receive the most important rays. The rays of greatest importance are those which emanate from the object of visual attention. If these rays are not in the visual axis, then a reflex-movement sets in, in order to change the direction accordingly. I have called this movement the ***stimulotrope*** movement of the fovea.[8] Within narrow limits the strength of the stimulus for this movement seems to increase in inverse ratio with the distance of the fovea from the stimulated para-foveal spot. For every eye there is a distance where the stimulus ceases to be effectual; then a voluntary duction can bring the fovea within the working range for the reflex of the stimulotrope movement.

An approximately parallel position of the visual axes is the anatomical position for the mammals equipped with a fovea. This position has brought the foveal visual line of either eye within easy distance from every object of foveal vision of the other eye. It enables the dual eye to perform every normal visual movement

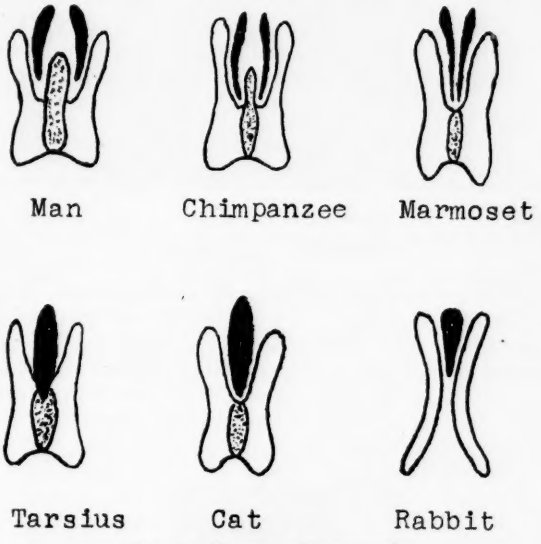


FIG. 1. (HUNTER-BROUWER)

Scheme of oculomotor nuclei in various mammals, all except Tarsius after Brouwer . . . (Edinger-Westphal nucleus is represented in black; nucleus of convergence is stippled).

through the reflex for the stimulotrope movements; by this favourable position interference by voluntary duction has become superfluous.

In the mammalian line the fovea begins with the felines, and is developed to its highest degree of perfection in man. Parallel with this development another development has occurred, viz: that of a centre for convergence in the mid-brain. I give here a schema by Brouwer to illustrate this occurrence[9] (Fig. 1). These two phylogenetic happenings prove that convergence is phylogenetically a very young function in contradistinction to ancestral functions, like accommodation. Young functions are plastic, in contradistinction to ancient ones which show more ease of performance, more machine-like fatality than young reflexes. Another characteristic of convergence is its great complexity. The same twelve

muscles, which are involved in the motor-co-ordinations of convergence, are—often even at the same time—involved in quite different movements as well.

It is evident that the centre for this young reflex has to assert itself; it has still to battle for the supremacy which is its birthright. On account of its youth and complexity a considerable individual plasticity could *a priori* be expected. For the same reason much individual difference in range and even insufficiency of the function are found. Both insufficiency and plasticity have been established by me in the diagnosis and the treatment of hundreds of eyestrain cases. By kinetic therapy the existing insufficiency in such patients can always be dealt with and the convergence brought to full range and power.[10]

The insufficiency of convergence I have called *astheno-vergence*.

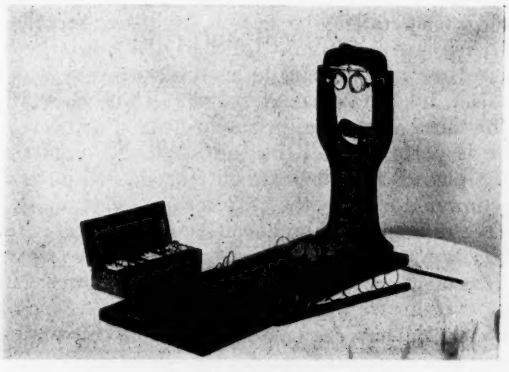
Method of Testing

I give here photographic pictures of the implements used by me in many thousands of tests. Every person was tested while sitting opposite a black cloth, 4 feet square, at a distance of 5 or 6 metres. In the centre of the cloth an oblong strip of white cardboard 7 cm. by 0·5 cm. was fixed in the middle. The white strip served as the object of vision. It was placed in the vertical position in the tests

OBJECT—VERTICAL POSITION.

OBJECT—HORIZONTAL POSITION.

The operator, even in the semi-darkness necessary for this treatment, can see his patient's eyes, and the movements can be watched through and alongside the parts of the frame.
The prisms are successively placed before the eye; the battery holds eight prisms of increasing strength. When the strongest is placed before the eye and the tested person announces the merging of the images, then a loose prism of the same strength is taken out of the box in front of the operator and by a deft movement placed in the frame; at the same moment the battery is withdrawn. It is now at disposal to start the same procedure in front of the other eye.



The stand is taken from the Javal-Schiötz ophthalmometer. The frame for the prisms is a trial frame sold by Zeiss, Jena.
The batteries of prisms are three in number :—

1. With 8 prisms, 1°—8°, base towards handle.
2. With 8 prisms, 0·25—2°, base 90° from handle.
3. With 4 prisms, 0·25—1°, base opposite handle.

The box contains	2	prisms	15°	1 prism	5°
	2	,,	10°	1 ,,	4°
	2	,,	9°	1 ,,	3°
	2	,,	8°	1 ,,	1·5°
	1	,,	7°	1 double prism	
	1	,,	6°	(Maddox)	

for horizontal convergences, and in the horizontal position in the tests for vertical convergences. The head of the tested person was supported by a rest for the chin and one for the forehead. Into the rest for the forehead a trial-frame was fixed for the prisms. The test was done by successively placing prisms of increasing strength (no revolving prisms!) in front of the eyes, until the images were no longer merged, but remained apart. The difference between the separate prisms I use for horizontal convergence is one degree, for vertical convergence it is one-quarter of a degree of prism. When the images were no longer merged, the preceding number of prism degrees was taken as the result of the test.

The Significance of the Test

When looking at a distant object straight ahead, the two lines traversing the foveae and the main focal points—the visual axes—although actually converging are nearly parallel. This, in contradistinction to the anatomical position, should be called the functional primary direction.

I speak of direction and not of position in order to remain on physiological ground and so to avoid the prevailing confusion. The almost parallel direction is *not* a position, but it is a function of visual activity. That direction can never be parallel—nor for practical purposes parallel—because it *is* convergence.

When prisms are placed in front of the eyes, the visual axes change their direction in order to let the broken rays, which come from the object, hit the foveae as before. In other words, notwithstanding the action of the prism on the direction of the rays, convergence is performed all the same. It is immaterial whether the prism be placed with its base out, or in, or up, or down, or in whatever combination of these positions, *the dual eye which* overcomes the difficulty of the deviation and *performs single vision, performs this by the power of convergence.*

I know this is an entirely new conception of convergence, but the above considerations forced me to its adoption.

Consequently the several movements of this convergence could be differentiated according to the different directions the front part of the visual axis takes in relation to the *primary* direction. Two main directions during convergence are the intra-primary and the extra-primary direction. Two other main directions are the two sursum-deorsum directions of convergence.

The point is that all these motor-co-ordinations are performed by the function of (involuntary) convergence. The degree to which a person by his or her involuntary convergence is able to overcome the action of the prism varies. That degree is the measure of such a person's power of involuntary convergence.

Examination of Bantu natives of South Africa

In preparing my thesis[1] I dealt exclusively with persons belonging to the white races, officially called "Europeans" in this country. My interest at that time was fixed on the difference between the patient with healthy eyes but with complaints of eyestrain and the normal person with no such complaint.

It appeared now of interest to examine another human race. By the courtesy of Dr. Orenstein, Chief Medical Officer of the Rand Gold Mines, I received facilities for testing healthy young persons of the Bantu race. At a dressing station on a gold mine, where about sixty natives were detained daily for minor injuries, I had at my disposal a room with suitable light and distance for the test. The officer in charge of the station and two of his orderlies assisted me daily for about two hours for more than three weeks. This, combined with the almost military discipline at the station, created an atmosphere which rendered possible an investigation of such delicate nature on such a scale. Superstition, fear and other disturbing factors would have precluded even an attempt at such a test on similar natives in their own homes in the native territories or even in the mine compounds. But as it was, a happy spirit prevailed amongst these natives and they showed great interest in the proceedings.

Diagrams

I attach hereto a chart showing three groups of three diagrams. The groups are marked I, II and III.

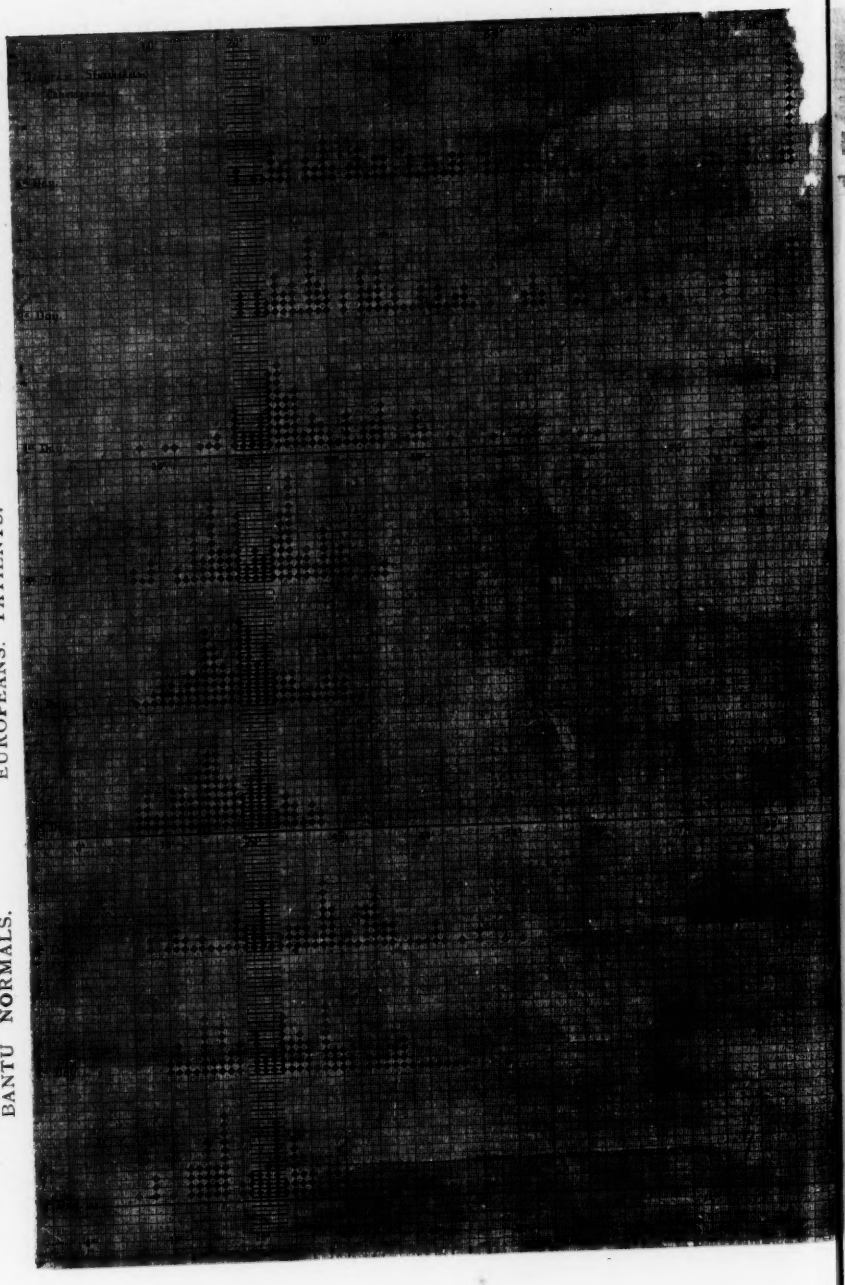
Group I deals with normal Europeans.
Group II „ „ European eyestrain patients.
Group III „ „ normal Bantu natives.

Each person was tested on three different days. Therefore a test-result of every person appears in every one of the three diagrams constituting the group.

All groups are on the same abscissa, and on this abscissa I have set out the degrees from 0°—90° of prism principal angle.

Each square represents the result of the test on one person on one particular day. Thus the one square on the extreme left in the left bottom corner means that on the first day of testing Bantu natives, one individual had 6° as his test result. In the same way the 14 squares on top of one another in Group I, third testing day, mean that 14 individuals reached the convergence of 84° on that day. This last result is somewhat inaccurate as higher degrees cannot be scored with the present apparatus. Some of these 14 squares should really be distributed over an area beyond 84°.

DIAGRAM: INVOLUNTARY CONVERGENCE (Stutterheim)



Conclusions

The conclusions that can be drawn are:—

(1) On comparing normal Europeans (I) and Bantu (III) it will be seen that the Bantu results are distributed round a lower average than those of the Europeans. This difference would appear to be about 15°. In other words: the Bantu race evidently has a less developed centre of involuntary convergence.

(2) It will be seen that in the normal Europeans there is a great shifting of the squares to the right on every succeeding day. In the Bantu this shifting to the right is much less pronounced, and hardly ever does an individual reach as high a degree of improvement as the European normals frequently do. In other words, the Europeans are nearly all capable of reaching a high degree of this convergence, either on the first test day or on one of the following days. It must not be forgotten that three days is a short time for achieving great improvement. I know from experience that normal Europeans will keep on improving day after day and that, with very rare exceptions, all of them can reach about 80°. It seems quite unlikely that such a thing would be possible in the majority of the Bantu.

I had an opportunity to put two young natives to the test to see how native convergence would respond to more prolonged treatment identical to that I had given to Europeans. One of the natives hardly made any progress, and remained below 30°. The other, a keen intelligent man, who did much of the administration of the station, I could not bring higher than 42°.

(3) Comparing the data for patients and for normal Europeans, it strikes one that the shifting to the right during these three days is very much slower in the patients. The patients also start at a very much lower average level than the normals. From experience I know that, although the shifting to the right is slow in patients, it is very consistent. Practically all patients can by methodical treatment be brought to a level of 70°—84°.

(4) Throughout all the diagrams I have indicated by means of horizontal lines, which together produce the impression of a ladder, the range of degrees of convergence necessary for reading. I consider this reading-distance as the minimum distance of most of the near work of binocular vision, and for that reason of very great importance in binocular economy. It is evident that the bulk of the patients are below the range of convergence required for that distance, that the normals are chiefly well above it, and that the Bantu are somewhat evenly distributed on either side. This, to my mind, gives the most suitable explanation of the eyestrain complaints arising in patients when doing near work, of the absence of eyestrain in normals in similar circumstances, and of the apparent

unsuitability of the Bantu as a race for following pursuits which entail much accurate, frequent and persevering near work.

Summary

A new conception of convergence is proposed. This conception does away with current ophthalmological opinion on convergence.

The new conception of convergence affects the diagnosis of asthenopia. It displaces the centre of gravity in that diagnosis from the static factor of monocular refraction in the direction of the kinetic factor of functional binocular ability.

An important physiological difference was found in this function between the Bantu and the European.

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TWO RARE CORNEAL CONDITIONS

I. Acute Conical Cornea
II. Keratoconus Posticus Circumscriptus

BY

T. HARRISON BUTLER

BIRMINGHAM

Case I

FUCHS (*Lehrbuch der Augenheilkunde*, 14th Ed., p. 408) mentions a condition which he calls *acute conical cornea* and describes it in the following words:—"The alteration in the curvature of the cornea sometimes causes spontaneous rupture of Descemet's membrane and its endothelial lining. Then the aqueous seeps into the corneal parenchyma causing it to swell and become cloudy.

The keratoconus shows a white-grey opacity over a large surface, and rapidly bulges forward; while the neighbouring tissues become thicker. After a time the endothelium regenerates, covers the rift, and again seals off the corneal parenchyma from the aqueous. The cornea slowly regains the appearance it exhibited before the development of the tear. The edges of the rupture alone remain visible as fine white lines."

The following is probably an example of this process:—

S. G., aged 28 years, came to the Eye Department of the Coventry Hospital on October 1, 1928, complaining that he had something in his eye. Examination showed a "rust ring" near the centre of the left cornea. There was no history of any accident, but as the man was a miner, the foreign body was probably coal or rock. The foreign particles were scraped off, and on October 3 a note was made that the abrasion was still present on the cornea.

The acuity of the right eye was 2/60 not improved by spheres, that of the left was 6/36 c. − 2·0 D. sph. = 6/18. Both fundi showed early posterior staphylomata and the tigroid appearance of high myopia.

No note was made of the condition of the corneae, but, as they were both examined, it is certain that no obvious conical cornea was present.

The patient was suffering from the effects of a foreign body, and his refraction was merely tested in the routine manner by the sister. He was told to come again when the irritation had subsided to have a proper estimation made of his refraction, but he did not reappear till December 15, 1930, two years later.

He now had a fully developed conical cornea of the R. eye quite typical in appearance. The cone was acute with a sharp apex, where there was a very obvious nebula.

The visual acuity of the right eye was now reduced to hand movements. The acuity of the left eye, the eye that had been injured by a foreign body, with − 4·0 D. sph., and − 4·0 D. cyl. at 80° was 6/18.

In two years the right eye had developed a conical cornea and the refraction of the left had altered considerably.

Examination with the slit-lamp showed that the conical cornea had nothing in common with the orthodox variety. The right cornea was enormously thickened at the apex of the dome. There were large cavities under the epithelium, which did not raise it above the common surface. At the base of the cone, in the region of Descemet's membrane, there was a large bleb, which was seen only by retro-illumination. The left cornea had superficial opacities here and there, and in the region of each opacity the cornea was thin. There was no suggestion of any ectasia of the left cornea, or of keratoconus.

The appearance of the right cornea is shown in Fig. 1. The extreme thickening of the apex of the cone is obvious. The spaces under the epithelium are seen, and at the posterior surface the large bleb, seen only by retro-illumination. No details are shown in the region of Descemet's membrane because this was obscured by the density of the apex.

Fig. 2 pictures the left cornea, and shows the irregular thickness and the areas of sclerosis, which appear as nebulae by oblique illumination. Both corneae are in "optical section."

On January 5, 1931, the patient appeared again. He had developed a small ulcer at the apex of the cone, with some circumcorneal injection. This rapidly healed under appropriate treatment. Unfortunately I did not see the patient myself at this time, and no examination was made with the slit-lamp.

On March 31, 1931, the left eye was again examined for refraction with the following results:—V.L., c. − 4·0 D. sph., − 2·0 D. cyl., axis 90° = 6/9 partly. It is remarkable that such a distorted cornea allowed such good acuity. Here again the case came up on a day taken by my assistant and I had not the opportunity of examining him with the slit-lamp.

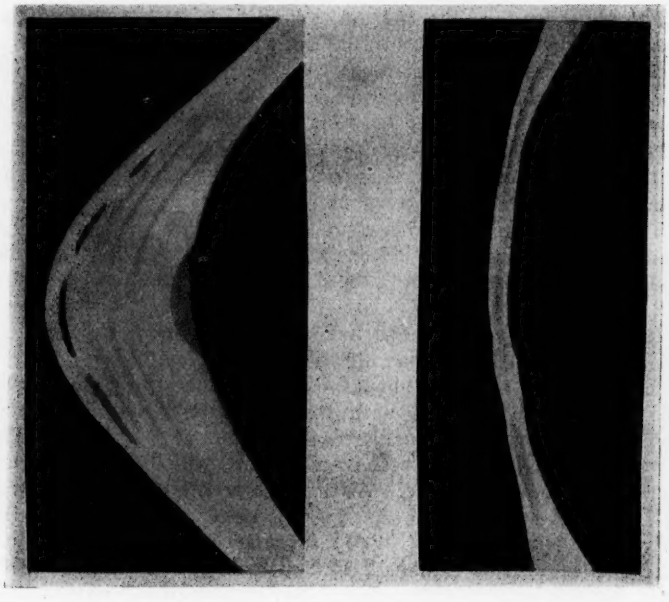

FIG. 1. FIG. 2.

On August 17, 1931, I examined him and found a remarkable change. The conical cornea was present as at the first, but the apex was not so acute. The slit-lamp showed that all the thickening had disappeared. There were no blebs and no spaces under the epithelium. The cornea had exactly the same appearance under the slit-lamp as the left cornea. It was irregular in thickness, but on the whole thinner than a normal cornea. The only difference was that the right cornea showed a fully developed keratoconus whereas the left had a normal shape.

The right fundus could be seen only with difficulty and no detail could be made out. The vision had fallen to perception of light.

It seems obvious that the changes which took place in each cornea were fundamentally the same, but that in the right a rupture of the endothelial layer had taken place which led to the acute keratoconus.

Case II

At the Oxford Ophthalmological Congress in 1930 I read a paper describing certain anomalies of the posterior curvature of the cornea which I called keratoconus posticus. This condition is characterized by a perfectly regular, geometrically precise increase in the curvature of the posterior surface of the cornea, giving a cornea that is much thinner in the centre than it is at the periphery. The paper will be found in the *Transactions of the Ophthalmological Society*, Vol. L, p. 551.

After the Congress I received a communication from Mr. P. L. Stallard describing a case in which the alteration in curvature was confined to the central part of the posterior corneal surface.

He had examined in India a middle-aged Mahratta who had in one eye an acuity of only 6/24. There was a confused whirling retinoscopy reflex. The Placido rings were quite circular, and the reflections of the keratometer mires were regular. The narrow beam of the slit-lamp showed a central corneal anomaly. It was best described as the appearance that one might expect if into the posterior surface of a plastic cornea one had excavated a subsidiary small basin-like depression by pressing into it a marble of much smaller diameter than that of the corneal surface. This basin occupied about half the corneal area, and its surface appeared to be a perfect curve. As this man was a railway worker, and would have his sight examined on entry, it is probable that the condition was acquired.

One would imagine that a case of this kind was almost unique, but on October 22, 1930, I discovered another.

W. S., aged 29 years, came to the Eye Department of the Coventry Hospital asking for glasses.

The right eye had been removed three years previously after a blow with a spanner.

The acuity of the left eye was 6/12. He said that he saw better with a + 2·0 D. cyl., axis 30°, but he did not read more than 6/12 with this correction.

Retinoscopy, performed without a cycloplegic, was difficult owing to the distortion of the shadow, and to a central "optical opacity," a horse-shoe like central shadow, open above. The retinoscopy appeared to give + 2·5 D. in one meridian, + 4·5 D. in the other.

The fundus was perfectly normal and was seen with ease. There was no paralactic distortion. I thought that perhaps the retinal sheen was exaggerated for the man's age.

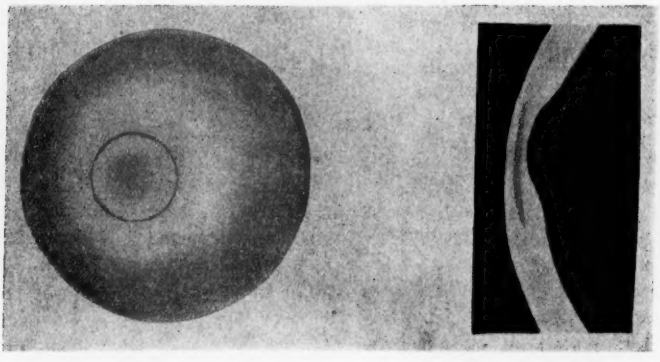

FIG. 1. FIG. 2.

Examination with Placido's rings showed no distortion, and no abnormality could be seen by examination with the loupe and oblique illumination.

Examination with the narrow beam of the slit-lamp revealed a condition similar to that described by Mr. Stallard, except that the basin-like depression was smaller and not quite central.

Careful focusing showed that there was slight flattening of the external corneal surface opposite to the posterior basin, and that there was some sclerosis of the cornea in this region. The appearance of the cornea seen in optical section is shown in Fig. 2. Fig. 1 shows the situation and extent of the bowl.

I have recently re-examined the case, after an interval of nearly a year. The flattening of the anterior surface is now easier to define, and the angle of the cylinder has altered. The present refraction is: V.L. c. − 2·0 D.cyl. at 180° = 6/9 partly.

No abnormality can be detected with the ophthalmoscope.

The patient now remembers that about four years ago he had a splash of hot lead into the left eye. He was at work next day and felt no ill effects from the accident.

It is striking that in Mr. Stallard's case the acuity was 6/24 and in mine 6/9 partly. The explanation must be that the refractive index of the cornea is so near to that of the aqueous that irregularities of the posterior surface have not a great effect upon the refraction. A very small irregularity of the anterior surface causes great distortion because the difference between the indices of the air and the cornea is great. In spite of this explanation it is surprising that a large bowl-shaped depression which was not even centrally placed should allow an acuity of over 6/12.

It is difficult to be quite certain that any change took place in the cornea during the year that it was under observation, but a year ago I did not notice the flattening of the anterior surface. The case was shown to the Midland Ophthalmological Society and my colleague, Mr. Rudd, thought that it was present. To-day it is obvious, and so it is probable that a change has taken place. The alteration in the angle of the cylinder and the improved acuity is further evidence of change. The presence of an area of sclerosis in this part of the cornea suggests that the anomaly is due to contraction, and this must probably be ascribed to some inflammatory process induced by the lead burn. Judging by my drawing made a year ago, and the present appearance, I think that the bowl is now less steep and that the edges shelve off more into the surrounding cornea than they did at that time.

SPONTANEOUS CURE OF CATARACT

BY

T. HARRISON BUTLER

BIRMINGHAM

IT is well known that changes may take place in a nuclear cataract which end in restoration of sight, but it cannot be often that all the stages of this transformation have been observed.

I have already recorded one example of this process in "An Illustrated Guide to the Slit-lamp," p. 85. Here the nucleus of a cataract had diminished in size, and the whole of the cortex had become fluid, with the result that the nucleus dropped below the line of sight, and the patient obtained with a suitable spherical correction an acuity of 6/18.

The following is another example:—

Mr. A. B. consulted me in my rooms on March 24, 1914.

The right lens had been extracted by Mr. Fulford Eales in June, 1913. The vision of this eye, with suitable correction, was 6/5 partly. The media were clear, and the fundus normal in all respects. The left eye contained a mature cataract. I made no note of anything unusual in its aspect.

On May 17, 1927, thirteen years after the first visit, Mr. A. B. consulted me again. He complained, "that the sight of the left eye was returning, and that in consequence he was greatly worried by diplopia, and had difficulty in appreciating the distance of objects." His uncorrected vision with this eye was now 2/60.

I found marked iridodonesis. The lens nucleus had dropped, exposing about one-third of the pupil, and through the clear segment I obtained a perfect view of a normal fundus.

The appearance seen by ordinary focal illumination is shown in Fig. 1. There is a shrunken opaque nucleus floating within the capsule. Fig. 2 shows the lens in *optical section*, viewed with the narrow beam of the slit-lamp. There is centrally a hard shrunken

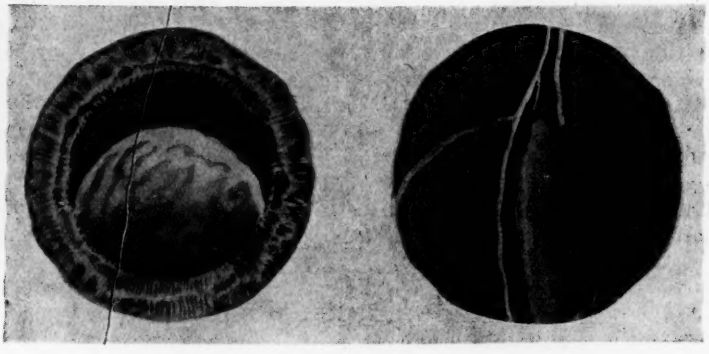

FIG. 1. FIG. 2.

nucleus floating in the capsule. In addition to the anterior and posterior capsule, there is attached to the anterior capsule, above, a third membrane which is figured in the drawing. This may be either a fold in the capsule, or, as I think more probable, a remnant of the condensed lens tissue that covers the adult nucleus, a sort of "internal capsule." In many senile lenses the line of demarcation between cortex and adult nucleus is so definite that it gives the impression that the central part of the lens is enclosed in an internal capsule. A drawing of a lens of this type will be found on p. 87 of the work mentioned above.

On April 12, 1930, I examined my patient again, and found that the nucleus had now sunk so far down, that only its upper edge could be seen. It was now clear of the normal pupil area. The acuity with + 10·5 D. sph., and + 0·5 D. cyl., axis horizontal was 6/9. The media were perfectly clear, and the fundus normal. The capsules were normal in texture, and showed no thickening or opacity.

Spontaneous cure of cataract may result from absorption of the

whole contents of the capsules. The following is an example:—Some ten years ago, Miss Ethel White, my House Surgeon at the Warneford Hospital, Leamington, performed a preliminary iridectomy upon an elderly man. The operation, performed under my immediate supervision, was technically perfect, and I feel certain that the capsule was not wounded. Careful examination with focal illumination and a lens failed to reveal any lesion of the anterior capsule. The operation was followed by considerable inflammatory reaction, which cleared up perfectly. After about a month I detected a notch in the north-west quadrant of the lens. At first it was only just visible and I regarded it a congenital notch in the lens. An anomaly of this nature is figured in my "Guide to the Slit-lamp" on p. 105. The defect gradually increased in size, till eventually after about six months the whole lens absorbed, and the patient reaped all the advantages of an extraction without the danger and trouble of this operation. The process began far away from the site of any possible puncture of the capsule and I am quite certain that it was not in any way caused by such an accident. It may have been due to the inflammation or to some change in the nutrition of the lens induced by the iridectomy.

My first case has some bearing upon the discussion that has recently taken place regarding the advisability of operating upon a single cataract. The fact that occasionally a Morgagnian cataract develops has been given as an excuse for extracting a cataract when the other eye has adequate vision. This condition is not the normal end of a senile cataract, it is a disease of cataract, and is rare in England. In Palestine we saw Morgagnian cataracts fairly frequently, but we never regarded the extraction as unusually difficult; in fact, my colleague, Mr. Edmund Cant, used to say that he preferred them to the ordinary extractions. I have seen several patients, some of them my own, who complain bitterly of the diplopia caused by the removal of a single cataract. One example is impressed upon my memory. A personal friend of mine was the fortunate possessor of two perfect eyes with an acuity of 6/3 easily. Unfortunately his teeth were not equally perfect, and an apical abscess led to the development of a posterior cortical opacity in one lens, the so-called *cataracta complicata*. The whole lens became rapidly opaque. I strongly advised him to have nothing done, warning him that successful operation would be followed by diplopia. However, he had the cataract removed in Switzerland, and suffered from intolerable diplopia. I could only advise him to wear a ground glass in front of the aphakic eye. Quite recently I saw a lady who had had a single cataract removed. She not only complained of very troublesome diplopia but had developed post-operative glaucoma.

The patient A.B. described above began to complain of double-vision when the acuity of the left eye was only 2/60.

DIABETIC RETINITIS IN A PATIENT AGED TWENTY-TWO

BY

P. H. ADAMS

OXFORD

DIABETIC retinitis is commonly regarded as a late condition found in elderly diabetics and considered to be secondary to the vascular changes which occur, rather than to the diabetes as such. The following case, therefore, seems to be of sufficient interest and importance to justify publication.

C. H., aged 22 years, came to the Oxford Eye Hospital, on October 16, 1931, complaining of pain in the right eye for the past week. On examination, the right eye was injected and the pupil was filled by a greyish exudate which also obscured all details of the iris. The left eye was quite quiet, pupil circular and active, and iris normal.

V., R. Hand movements. L. 6/9.

He was admitted to hospital, and the urine was found to contain a large quantity of sugar. He was treated for the iritis and in 5 days the exudation had absorbed.

October 24. On examination of the right fundus by my house surgeon, Miss Belt, she found the superior temporal vein somewhat engorged, with some yellowish areas of retinitis at the macula.

Urine, sp. gr. 1015. Sugar, 2·2 per cent.

He was examined by Dr. Stobie, physician to out-patients at the Oxford Eye Hospital, who found the blood pressure 100/75. Knee jerks, right side, just present. Left side quite definite. Wassermann reaction, negative.

October 27, 1931. I made a further examination and found definite yellowish areas of retinitis just above the macula, below the superior temporal artery, and also some fine flecks just below the macula. There was a particularly well marked shot-silk reflex round the macular region, especially on the outer side and about three discs breadth to the inner side of the disc there was a small mossy haemorrhage.

Left eye. There was a similar well marked shot-silk reflex round the macula; about 1 disc's breadth up and in from the disc was a small mossy haemorrhage and there were several small punctate haemorrhages scattered about the fundus. There were no obvious signs of disease in the retinal blood vessels.

Dr. W. T. Collier, physician to the Radcliffe Infirmary, kindly examined the patient for me and reported as follows:—"I can find nothing abnormal in this boy, apart from the diabetic condition. Examination of heart, lungs and abdomen, negative. The urine contained a very fair amount of sugar, a very faint trace of albumen

and no acetone or diacetic acid. The blood sugar at 2.30 p.m. was 0·3 per cent."

On enquiring into the past history, I was informed that the diabetes was discovered first about two years ago when he had had some injections of insulin. On the suggestion being made of this treatment being resumed, the man promptly bolted and we have seen no more of him.

We have here then a definite case of diabetic retinitis in one eye and typical haemorrhages in the other eye in a man of 22 years of age without obvious signs of diseased blood vessels and with a blood pressure of only 100/75.

COMMUNIQUE

International Association for the Prevention of Blindness

THE General Assembly of the International Association for the Prevention of Blindness was held in Paris, 2, Avenue Vélasquez, on Saturday, November 14, 1931, at 2 p.m., under the Chairmanship of Prof. de Lapersonne. The numerous personalities attending this meeting included: Mlle. de Teincey, representing H.R.H. the Duchess de Vendôme; M. Lévesque, representing the Minister of Health; M. Pigot, representing the Direction of Public Health; Military Intendant Bouscasse, representing General Pau, Chairman of the French Red Cross; Countess de Galard and Madame Barbier-Hugo, Presidents of two branches of the French Red Cross; Prof. Terrien and Dr. Morax (France); Dr. Pantaleoni, representing the League of Nations; Dr. Park Lewis, Vice-President of the International Association and of the National Society for the Prevention of Blindness, representing the United States; Prof. van Duyse (Belgium); Dr. MacCallan; Dr. and Mrs. Cridland (Great Britain); Prof. van der Hoeve (Netherlands); Prof. de Grosz (Hungary); Prof. Angelucci and Prof. Maggiore (Italy); Dr. Marquez (Spain); Dr. Zachert (Poland); Dr. Lossouarn, Chairman of the Chinese League for the Prevention of Blindness; Dr. Patry (Switzerland); etc.

PROF. DE LAPERSONNE outlined the work accomplished by the Association during the past year, laying particular emphasis on the formation of National Committees in the Argentine, Belgium, Brazil, France, Germany, Hungary, Italy, Mexico, Poland, Portugal and Spain. He pointed out that the composition of these Committees should be as representative as possible, the object of the Association being to reach all classes of the community. He reminded his audience of the great work done in America and Great

Britain as regards sight-saving classes for the education of children with defective eyesight; thanks to specialized methods of teaching, these children are given a chance of becoming normal members of the community. DR. HUMBERT, Secretary General of the Association, had brought the subject before the Child-Welfare Committee of the League of Nations. Hundreds of Paris school children had been examined for ocular defects. The Association's Secretariat had acquired, for demonstration purposes, samples of the special material used in these classes. It was expected that a sight-saving class would soon be started in Paris.

In the absence of representatives from Germany and Argentina, DR. A. CHURCHILL, Associate Secretary General, mentioned the formation of National Committees in these two countries.

Prof. van Duyse (Belgium), Dr. Coutela (France), Dr. Zachert (Poland), Prof. Maggiore (Italy), Dr. Marquez (Spain), Prof. de Grosz (Hungary), spoke on behalf of the newly constituted National Committees. Dr. Cridland (Great Britain) stated that he hoped a national organization for the prevention of blindness would soon be established in England.

DR. HUMBERT, General Secretary of the Association, read a report on administrative matters during the year. On behalf of the Association he expressed his gratitude to those who had helped to promote its work and ideals; he mentioned especially the French Ministry of Public Health, the General Insurance Committee, and the National Society for the Prevention of Blindness, whose powerful and unfailing support had enabled the Association to make good progress. He also expressed his gratitude to Dr. Cridland, who had brought a generous contribution from an anonymous donor. He was glad to say that at the end of the fiscal year 1931 assets were almost three times as large as at the beginning of the year,

Dr. Humbert joined Prof. de Lapersonne in expressing his warmest thanks to Dr. Cridland and other delegates who had come to Paris on purpose to attend the Association's annual meeting.

Dr. Humbert added that the Association would be in a position to organize, in 1932, its Secretariat on an independent and autonomous basis, a step which would help to widen its sphere of influence.

DR. COUTELA, General Secretary of the French Committee, submitted a report on "Present Legislation and Prophylaxis of Industrial Eye-accidents." He observed that this was a most important and up-to-date item in the Association's activities.

Any person suffering from an industrial eye-accident receives, while unfit for work, an indemnity. In France and most other countries this indemnity is equal to half the workman's salary, but it is only due if work is interrupted for more than four days.

In other cases—known as minor injuries—the sufferer receives no indemnity. As approximately 80 per cent. of wounds of the eye come within the category of minor injuries, the great majority of eye accidents do not, as a rule, entitle the sufferer to any indemnity for cessation of work.

The result is that workmen with eye injuries, knowing they get no indemnity for such minor troubles, think twice before interrupting their work; the consequences of delayed or incompetent treatment are too often disastrous. The temporary disablement is prolonged and may even be followed by permanent disablement. Among the possible remedies to such a condition of affairs, the speaker suggested the awarding of a premium for immediate treatment, to the workman who had his eyes attended to at once. He observed that eye-injuries were different from all other industrial hazards and that it was necessary either to provide for special legislation or for a modification of existing Acts with regard to this category of accidents.

M. MAX HERMANT, of the General Insurance Committee, seconded the speaker's conclusions and a resolution to this effect was unanimously adopted by the Assembly.

DR. CRIDLAND (Great Britain) then read a report on "The Value of a Complete Investigation of the Causes of Blindness as a First Step in Prevention." Everybody agreed that the first step in the prevention of a disease was a complete knowledge of its cause, and the knowledge of the cause of a disease could not be said to be complete unless one knew how frequent it was. We are already possessed of a knowledge of most of the causes of blindness, in spite of the fact that from time to time one still meets with rare cases in which one is unable to assign the actual cause of blindness, although the pathological changes in the eyes themselves which lead to this result may well be recognized.

We have not, however, a very definite knowledge in any country as to the exact frequency with which these causes occur, in other words we do not accurately know how common this or that cause of blindness is.

The ideal would be that one should have exact statistics as to the causes and frequency of blindness over the whole world. At present such an ideal would be impossible, but something in that direction can be attempted. The question comes as to how even an attempt can be made.

Dr. Cridland then described the system used in Great Britain. Each blind person in the United Kingdom was in receipt of a pension, but before that pension could be obtained, it was necessary for the candidate for the pension to produce a certificate stating that he was "too blind to perform work for which eyesight is essential."

By this means an opportunity was given, not only of knowing how many blind persons there are in the country, but, at the same time, of learning something of the cause of their blindness and its degree.

The Council of British Ophthalmologists had recently drawn up a report on the certification of blind persons, in which attention was drawn to the importance of the fact that the examination of a candidate for a blind pension should be made by an expert in ophthalmology if it was to be of real scientific value.

It was only in this way that a reliable census of the causes of blindness throughout any country could be obtained.

In conclusion, Dr. Cridland put forward the suggestion that at some future date the Association should consider the advisability of drawing up a schedule of the causes of blindness which might be used uniformly in all countries. The proposition was accepted after a speech to the same effect by DR. MARQUEZ (Spain).

Finally, DR. PARK LEWIS (United States), Vice-President of the Association, gave an address with cinematographic projections on "Certain Rare Forms of Cataract of a Parasitic Nature observed in Fish." He reminded his audience that at a conference in the City of Washington recently, a report was read by a representative of the Department of Public Health, in which he described the infestation of the native Indians by a filarial worm. An entire village of over seven hundred people as the result of this infestation had become to a greater or less degree blind. The infections were due to the transmission of the larvae from one to another by means of one of several varieties of gnats. An invasion of a parasite involving the eyes of such a large number of people had again called attention to the importance of parasites in relation to the eyes and while the subject of the present brief paper had no connexion with the filarial worm, the existence of other parasites in the eyes of living creatures to such an extent as to make the lens almost the normal habitat of certain variety of flukes could not fail to be of interest to ophthalmologists.

The speaker pointed out how these observations were a further inducement to extensive research in the treatment of cataract in human beings, an activity which came within the scope of blindness prevention.

In the course of the meeting the General Assembly unanimously re-elected its Executive Committee and staff, the latter being constituted as follows:

President: Prof. de Lapersonne (France).
Vice-President: Dr. Park Lewis (United States).
Secretary General: Dr. F. Humbert (Switzerland).
Treasurer General: M. R. Demachy.
Correspondent for the United States; L. H. Carris.
Associate Secretary General: Dr. A. Churchill.

ABSTRACTS

I.—NEUROLOGY

(1) **Koyanagi, Y.** (Sendai).—**On cavernous optic atrophy.** (**Ueber die cavernöse Opticusatrophie**). *Arch. f. Ophthal.*, Vol. CXXIII, 1930, p. 537.

(1) Cavernous optic atrophy, here the subject of a very thorough research and analysis by **Koyanagi,** is a condition in which the ocular end of the nerve is studded with numerous holes of varying shape, which have undoubtedly developed from the degeneration of pre-existing nerve fibres. This process leads to the formation of larger spaces in the later stages, in which the glial fibres are also involved, and may extend upwards towards the brain.

The view that this degeneration is confined to the part of the nerve in which the central vessels run is not yet proved; in the rabbit at any rate it may extend beyond the point of their entrance.

In the initial stages of this atrophy, when the holes are filled with débris or lymph, there is certainly only a simple degeneration of nerve fibres, in contrast to ordinary optic atrophy, in which proliferation of glial tissue keeps pace with the progressive degeneration of the nerve fibres and takes their place. In later stages, however, it is accompanied by a definite increase in the glia, which is characterized by a closer inter-weaving of their fibres.

It is, in the author's opinion, very doubtful whether the nerve fibres in glaucoma always undergo ganglion-like swelling as a preliminary step to cavernous degeneration. At any rate in high myopia and in orbital tumours with intense exophthalmos, in which the optic nerve not infrequently exhibits typical spaces, such a change is practically never observed.

In high myopia with typical cavernous formation in the optic nerve it is not always necessary to assume an association with glaucoma, because he holds that the formation of spaces is no longer of specific importance for the diagnosis of the latter condition. A proof of this lies in the fact that in a growing orbital tumour with extreme proptosis the ocular end of the optic nerve often exhibits cavernous degeneration.

The view that glaucoma is often present in progressive tumours of the orbit as the result of their pressure on the eye, is not finally proved. An increase of the protein content in the anterior chamber and cellular infiltration in the spaces of Fontana have been at times observed, but these changes by no means afford proof of an uncompensated glaucoma of some standing.

Moreover in non-glaucomatous eyes the anterior chamber may become distinctly shallower when the growing orbital tumour produces in the eye a deformity which later leads to a progressive compression of the vitreous, without necessarily raising the tension abnormally. Indeed, a diminution in the tension through retinal detachment is more likely to occur.

The question as to whether an uncompensated glaucoma is really due, as has been suggested, to stasis in the choroidal vessels, is still open to debate.

Koyanagi discusses the variations in the intra-ocular pressure in cases of orbital tumour, and concludes that they produce, not a rise, but a fall in tension, due to a disturbance in the circulation behind the eye with diminished flow of blood to the interior of the eye and to direct mechanical pressure on the globe.

There is no longer any doubt that typical cavernous degeneration in the optic nerve may develop in eyes with permanent hypotony due to orbital tumour, just as in high myopia, without the onset of glaucoma. The view that Schnabel's spaces in the optic nerve are pathognomonic of glaucoma is no longer tenable.

As regards the cause of cavernous optic atrophy the author does not directly contradict the view, held by some writers, that in glaucoma and even in orbital tumours it is most improbably the result of lymph stasis in the optic nerve, but in this connection he points out that in non-inflammatory papilloedema this form of atrophy is practically never found. In orbital tumour with marked proptosis it is, in his opinion, due to abnormal stretching of the optic nerve fibres causing rupture at the point where they are least resistant: this view probably also holds good in glaucoma.

THOS. SNOWBALL.

(2) **Bainbridge, W. (Hull).—Optic atrophy with retinal changes caused by high tension current.** *Brit. Med. Jl.*, December 6, 1930.

(2) **Bainbridge** describes the fundus appearances in the case of a man whose vision declined six months after he had been burnt and rendered unconscious following an electric shock, with a current of 460 volts A.C.

There was pallor of each optic disc with widespread superficial choroido-retinitis, and each eye showed angeoid streaks. The vision was reduced to 6/24—6/36, and the visual fields much constricted. Watched over a period of many months the condition remained unchanged, and no cause other than the possible sequel to the electric shock, was found.

R. C. DAVENPORT.

(3) **Santori, G.—Retrobulbar neuritis. (Le neuriti retrobulbari).** *Boll. Ocul.*, September, 1930.

(3) In this long paper **Santori** discusses the aetiology of retrobulbar neuritis, and its treatment; he holds that an undue importance has been laid on infection of the accessory nasal sinuses, and that these have been too often the seat of unnecessary operations. The general course of the disease is towards improvement, and no operation should be undertaken until other methods have been given a fair trial, and until a radiogram has shown the presence of sinus disease to be a probability.

HAROLD GRIMSDALE.

(4) **Dejean, Ch. (Montpellier).—Bi-nasal hemianopia. (L'Hemianopsie bi-nasale).** *Arch. d'Ophtal.*, April, 1930.

(4) This paper, based upon a recent case, is largely a review of existing records. For the production of bi-nasal hemianopia, symmetrical lesions at each lateral border of the chiasma are necessary:—this, at least, is the classical theory. Such lesions, and a resulting hemianopia, are extremely rare; indeed the occurrence of a chiasmal bi-nasal hemianopia has been denied by some authorities (Rakowicz, Foerster, Shoemaker). The records of cases are few and ill-assorted, but such as they are, they may be separated into two groups, those ***with*** and those ***without*** ophthalmoscopic lesions.

The former are the more numerous and usually exhibit optic atrophy or neuritis passing into atrophy. Several cases belonging to this group occurred in tabetics, the progressive optic atrophy passing through a stage of bi-nasal hemianopia (Lang and Beevor, Price and Heed, Protopesco). Other examples not associated with tabes but occurring during an advancing atrophy, are reported by Herschell, de Schweinitz, Rönne and others.

Cases in the second group (without ophthalmoscopic changes), are much more uncommon, and considered to be undoubtedly chiasmal in origin, the lesion being vascular degeneration, meningitis or new growth.

In 1873, Knapp reported a case in which an autopsy revealed atheromatous degeneration of the vascular circle of Willis, and other observers report examples due to atheroma and aneurysm of the internal carotid artery.

Tumours of the hypophysis with bi-nasal hemianopia have been recorded by Wood, Uhthoff, and Hessberg; and meningitis, especially basal, has been the cause to which bi-nasal hemianopia has been attributed in several instances.

In only one of the cases collected by the writer is there any report of a post-mortem examination.

Dejean's patient was a boy aged 7 years: the clinical features of

the case are reported in detail. The cause of the hemianopia, without any reasonable doubt, was basal meningitis, leading probably to osteo-periostitis. Radiographs revealed some change in the outline of the anterior part of the sella turcica. There were no ophthalmoscopic lesions and apart from the defect of vision the child presented no clinical evidence of disease. A list of 14 references is appended.

J. B. LAWFORD.

(5) **Bennett, A. E. and Patton, James M. (Omaha).—Oculogyric crises in postencephalitic state.** *Arch. of Ophthal.*, September, 1930.

(5) **Bennett** and **Patton** give an account of seven cases of oculogyric crises. In six, modified Parkinsonism was present, but the seventh was not Parkinsonian. All cases exhibited spasmodic, conjugate deviation of the eyeballs, and most of them showed fluttering movements of the lids, associated with blepharospasm. Synergic movements of the head and neck often accompanied the attacks. The eyes were deviated in various directions and the duration of the deviation varied from several minutes to some days. Trance-like states often occurred, and emotional disturbances of the anxiety type were also frequent.

F. A. W-N.

II.—REFRACTION AND OPTICS

(1) **Mussabeili, U. C. (Baku, Caucasia).—The refraction in pterygium. (Ueber die Refraktion bei Pterygium).** *Zeitschr. f. Augenheilk.*, Vol. LXXI, p. 237, 1930.

(1) That pterygium often causes diminution of visual acuity is well known, and the explanation generally advanced is that it is the result of part of the cornea becoming covered. **Mussabeili** investigated thirty patients (40 eyes) to find out whether any changes of refraction take place. In 24 eyes (*i.e.*, 60 per cent.) the refraction was less in the horizontal meridian than in the vertical, the difference ranging between 1·0 and 4·0 dioptres. Some of these cases were confirmed by the keratometer. (? refractions done under mydriatic. *Reviewer*). The author holds that as a result of the pterygium, there is flattening of the horizontal meridian and a consequent development of astigmatism with the rule. Only a few cases operated upon could be followed up, and in these the removal of the pterygium did not seem to affect the astigmatism, though in two cases seen by a colleague the astigmatism did decrease after operation.

ARNOLD SORSBY.

(2) **Stine, George H. (Colorado Springs, Colorado).—Variations in refraction of the visual and extravisual pupillary zones.** *Amer. Jl. of Ophthal.*, February, 1930.

(2) Stine made a study by retinoscopy under cycloplegia, of 277 normal eyes, examining five different portions of the pupil, namely, the central area and the superior inferior, temporal and nasal quadrants which abut on this area. He found that in the vast majority of eyes there was considerable variation of refraction between the central and peripheral zones of the pupil, in one case as much as 8 D. and that this difference varied in the two eyes of the same individual and in the different quadrants of the same eye. The variations were due chiefly to spherical aberration which might be positive, negative or mixed. The latter produces the well-known "scissors movement." In this the asymmetry was most commonly found in the upper and lower quadrants, the superior quadrant being the more myopic. In adults positive aberration was the most frequent finding, but 40 per cent. of children showed the negative or mixed forms, both of which present the most difficult type of skiascopic appearances. Symmetrical negative aberration was not found in any patient over the age of 19 years presumably because of growth and changes in refraction of the cortex and nucleus of the lens.

F. A. W-N.

(3) **Cucchia (Perugia).—The acuity of peripheral vision in the normal eye.** (*L'Acutezza Visiva Indiretta in Condizioni Fisiologiche*).

Quaglio.—Clinical examination of the acuity of peripheral vision in certain ocular diseases. (**Ricerche cliniche sul Comportamento Dell'Acutezza Visiva Indiretta in alcune Affezioni Oculari**). *Boll. d'Ocul.*, October, 1930.

(3) These two papers supplement one another. **Cucchia** has investigated the visual acuity of the peripheral retina, and for this purpose used the optotype devised by Contino, which can be varied in size. He found it advisable to examine the peripheral retina in two stages; the first included the retina up to 10° from fixation, and was made at 5 m. distance, at intervals of 2°.

The remaining area was tested at intervals of 5° at 1 m. distance. Since the size of the optotype can be varied from that corresponding to Snellen 5 to Snellen 50, the readings at 1 m. could give records of vision from 1/5 to 1/50. Lower than this could not be given.

Cucchia finds that acuity falls more rapidly towards the vertical, both upper and lower regions, than in the horizontal line; in the latter the temporal region of the retina was slightly more acute than the nasal. At 15° from the centre, visual acuity in the horizontal line was about 1/6, in the vertical, about 1/10.

Quaglio extending these examinations to diseased eyes finds in them a help in the diagnosis of certain conditions; in chronic glaucoma, for example, he finds the examination of the acuity of indirect vision to give earlier indications of defect than simple perimetry and at the same time its findings are more exact. Often the nasal field may seem full to perimetry but the acuity of the retina in that region will be found to be much reduced.

HAROLD GRIMSDALE.

(4) **Santonastasio, A. (Bari).—The state of refraction of the eye during the first years of life. (La Rifrazione Oculare nei primi Anni di Vita).** *Ann. di Ottal. e Clin. Ocul.*, October, 1930.

(4) **Santonastasio** has examined the eyes of a number of new-born children, and has in some cases made repeated examinations during the first years of their lives. He examined them first without any mydriatic, noting the refraction of the two principal meridians and any change that might occur when the source of illumination was changed in strength. He then examined after the instillation of 1 drop of a 1 per cent. solution of atropine; he states that good mydriasis was rarely secured.

In 75 per cent. of the cases examined without atropine, he found myopia of varying degree; in 7 per cent. over 10·0D. After atropine, the proportion of myopia was reduced to less than 50 per cent., and the degree much diminished. Separating the cases month by month, he finds a progressive reduction in the proportion of myopia until, at the end of the first year, the refraction is constantly hypermetropic. He concludes that the eye of the new-born has a greater refractive power than that of older children.

It is curious that he found the refraction constantly higher when a strong light was used for the examination and that it fell as the light was made weaker.

HAROLD GRIMSDALE.

(5) **Swab, Charles M. (Omaha).—Latent heterophoria as noted after prolonged monocular occlusion.** *Amer. Jl. of Ophthal.*, December, 1930.

(5) **Swab** gives an unprejudiced account of this procedure and is careful to emphasize that it is by no means necessary to use it as a routine. It can be recommended in the following types of case, where (1) asthenopia is not relieved by glasses correcting the error of refraction; (2) there is exceptional sensitivity to light; (3) there is a discrepancy between the phorias at 6 metres and at reading distance; (4) there is neurasthenia, inability to read for longer than

half an hour, or vertigo, headaches, etc., on watching moving objects; (5) there is twitching of the lids from intermittent spasm of the orbicularis fibres. Some cases, orthophoric before occlusion have been found to have as much as 6° of hyperphoria. The results are not universally applicable and the author states that on several occasions prisms that were prescribed after occlusion tests had to be removed later.

F. A. W -N.

(6) **Noiszewski, K. (Warsaw).—Accommodation for distant objects. (Accommodation pour la Vision des Objets éloignés).** *Arch. d'Ophtal.*, September, 1930.

(6) **Noiszewski**, having observed frequently that the visual acuity of myopes was noticeably improved by blinking ("clignement"), measured a degree of improvement in a series of 25 myopes. He gives, in tabular form, (*a*) the unaided vision; (*b*) the vision during blinking; (*c*) the concave lens which renders the vision equal to that obtained by blinking.

Here are three examples from his list:—(1) vision unaided 1/20; vision during blinking 1/10; $-3{\cdot}5$ D. vision = 1/10. (2) vision unaided 1/10; during blinking 1/4; $-1{\cdot}5$ D. vision = 1/4. (3) vision unaided 1/15; during blinking 1/4; $-2{\cdot}5$ D. vision = 1/4.

The author argues in favour of a power of accommodation for distance, by means of the tensor choroideae, Brücke's muscle, by which the retina and choroid are drawn towards the lens. A quite insignificant displacement of the retina would suffice to improve distant vision considerably.

In the cephalopoda, in which accommodation for both distant and near objects exists, the mechanism is by displacement of the lens backwards and forwards (Beer, Aleksandrowicz). Noiszewski suggests that the liability of myopes to detachment of the retina may be partly explained by the recurrent traction on the retina which, he thinks, occurs during this "accommodation for distant vision."

J. B. LAWFORD.

(7) **Kantor, D. W. (Minsk)—The racial aspect of myopia in compositors. (Zur Myopiefrage der Schriftsetzer in nationalem Aspekte).** *Zeitschr. f. Augenheilk.*, Vol. LXXII, p. 384, 1930.

The racial factor in the aetiology of myopia. (Ueber die Bedeutung des nationalen Moments in der Aetiologie der Kurzsichtigkeit). *Ose-Rundschau.*, Vol. V, No. 8, p. 1, 1930.

(7) **Kantor** finds myopia more frequent in a group of 365 Jews in Minsk compared to 374 White Russians, the incidence being 14·75 per cent. in the first group against only 4·93 per cent. in the

second. Amongst compositors the incidence is higher in both groups, being 22·8 per cent. and 6·1 per cent. respectively, the proportions thus remaining very much the same. No definite relationships between the incidence of myopia and the number of years worked as compositor could be established. Published statistics from other cities are cited to support the view that the incidence of myopia among compositors varies in different towns, the racial factor rather than the occupational thus seeming the more significant. In the proportions given above Kantor considered only spherical myopia. (Nothing is said of the method by which the refractive errors were estimated).

ARNOLD SORSBY.

III.—OPERATIONS

(1) **Bulson, Albert E. (Port Wayne, Indiana).—Surgery of the closed pupil.** *Amer. Jl. of Ophthal.*, October, 1930.

(1) **Bulson** is strongly in favour of Ziegler's method for dealing with a closed pupil, *i.e.*, for performing iridotomy. The essentials are as follows: (1) Ziegler's needle should be used. (2) The incision should be the shape of an inverted V. (3) The puncture should be made above, near the limbus and the iris punctures should be below, some 5-6 mm. apart and 3 mm. from the apparent circumference of the membrane. (4) The two incisions should not only meet above, but should cross, in order to be sure of dividing all the fibres. (5) If the flap does not retract, it may be pushed down with the point of the knife. The paper concludes with reports of three patients all of whom obtained useful vision though they had been given up as hopeless by the surgeons who had performed the original operations.

F. A. W-N.

(2) **Salzmann, M. (Graz)—Injury to the lens in iridectomy and its prevention by external iridectomy. (Iridektomie und Linsenverletzunge und ihre Verhütung durch die Iridektomia ab externo).** *Zeitschr. f. Augenheilk.*, Vol. LXXII, p. 127, 1930.

(2) **Salzmann** reports on 694 cases of iridectomy, 345 operations being for iritis and its sequelae (seclusion and occlusion of the pupil) and 349 for glaucoma, both primary and secondary. In 28 cases the lens was injured, four times in the first group and 24 times in the second, giving a percentage of 4 for the whole series, of 1 and 7 for the two groups separately. Of the 24 glaucomatous eyes in which this injury occurred, 10 were cases of absolute

glaucoma, seven advanced glaucoma, two buphthalmos, four acute primary glaucoma, and one glaucoma with retinal haemorrhage. Histological examination of such eyes as ultimately came to enucleation showed that in eight the damage was undoubtedly traumatic, caused by keratome, iris forceps or repositor. In some cases the cause of the lens opacity could not definitely be established, and no evidence of injury could be seen in at least two cases in which spontaneous rupture of the capsule must have led to the lens changes, the rupture itself being caused by too rapid emptying of the anterior chamber.

As the development of traumatic cataract leads to the loss of the eye, the author suggests an operative procedure in which no instruments other than the knife are actually introduced into the eye, a peripheral incision being made into the anterior chamber, so that a small prolapse of iris occurs. The operation is then completed outside the anterior chamber, and the pillars of the coloboma stroked back into position by corneal massage. Iridectomy thus performed has the advantage that the anterior chamber is emptied slowly, thus minimizing the risk of spontaneous rupture of the capsule.

ARNOLD SORSBY.

IV.—MISCELLANEOUS

(1) **Majewski, K. W. (Cracow).—A method of diascleral localization of ophthalmoscopic lesions. (Essai d'un repérage diascléral des lésions ophtalmoscopiques).** *Arch. d'Ophtal.*, July, 1930.

(1) **Majewski** describes a procedure, simpler than those commonly employed, for the registration on the surface of the sclera, of the site of lesions visible by ophthalmoscopic examination. He has devised and utilized this method chiefly in dealing with rents in detached retinae, but thinks that it might be serviceable in other diseased conditions. It is, as is true of other methods, more applicable to lesions situated at or anterior to the equator of the eye.

In ordinary diaphanoscopy the illumination of the interior of the eyes should be diffuse and widespread, but for the purpose under consideration a small point of intense light is required. By this means a limited intra-ocular area is illuminated, with a brighter central focus.

Majewski describes his procedure in the following words:—"Having found a hole in the retina I tell the patient to maintain steady fixation. At the same time an assistant applies the point of

the diaphanoscope on the surface of the sclera. To facilitate this manoeuvre it is well to anaesthetize the eye and to separate the lids by a blepharostat. To render the examination as brief as possible, I direct the movements of my assistant, 'To the right, to the left, nearer the limbus, nearer the equator,' etc., watching meanwhile in the illuminated area of the fundus a moving bright spot on the red choroid. At the moment when its brightest centre reaches the hole in the retina, I arrest, with an energetic "stop" the hand of my assistant. He at once marks on the bulbar conjunctiva the point of contact of the diaphanoscope. This indicates exactly the position for cauterization."

In eyes with deeply pigmented tissues the light is so dispersed that it is difficult and sometimes impossible to distinguish the central point of the light emitted by the diaphanoscope. In such eyes Majewski recommends examination of the fundus in red-free light, in which the central beam of the transillumination becomes brighter and is easily distinguished from the irradiated light which surrounds it.

A source of light for the ophthalmoscope may be unnecessary, the light from the diaphanoscope proving sufficient to illuminate the fundus.

In a prophetic spirit the author writes, "An exact localization of certain morbid foci in the retina or choroid may perhaps be essential to render possible local interventions, operative or medicinal, which the future of ophthalmology may have in store for us."

J. B. LAWFORD.

(2) **Behr, Carl (Hamburg).—Experimental papilloedema in man. (Die Stauungspapille im experimentum crucis hominis).** *Zeitschr. f. Augenheilk.*, Vol. LXXI, p. 275, 1930.

(2) **Behr** stresses the fact that the term papilloedema is an anatomical description rather than a clinical entity, swelling of the disc being seen in such a variety of conditions as intracranial lesions with or without increased intracranial tension, anomalies of the skull, purely orbital lesions, general conditions, and even local eye conditions, such as hypotonia following filtering scars. The one thing that all these conditions have in common is oedema of the nervous element in the papilla. He rejects the generally accepted theories on the ground that they only explain isolated groups of cases but not papilloedema in general. Behr holds that the cause is to be found in the damming up of parenchymatous juice which normally serves the metabolic needs of the optic nerve; he has shown experimentally that this juice flows from the papilla along the nerve to the interior of the skull, draining into the third ventricle and subarachnoid space. This parenchymatous juice has,

of course, nothing to do with the cerebrospinal fluid in the sheaths of the optic nerve.

A case reported by Mariotti is quoted by Behr as evidence that in man there exists such an axial stream in the parenchyma of the nerve, just as it exists in experimental animals. The case in point is one in which an embolic abscess spread along the nerve. Starting from near the bulbar end it spread axially towards the brain along the nerve-tissue; there was no extension of the septic process laterally towards the vaginal spaces. Meningitis developed by infection being carried intracranially by the parenchymatous route.

That papilloedema is due to interference with the normal, centrally directed flow of the parenchymatous juice, Behr has proved by the opportunity he had of tying the optic nerve in a man, in whom a normal eye had to be removed in excision of the upper jaw for malignant disease. During the operation, Behr tied the nerve at a point near the optic foramen, the ligature being applied not so tight as to interfere with the circulation of the ophthalmic artery. Before the eye was finally removed at the end of the operation, he had the opportunity of seeing the optic disc at 10, 20, 30 and 90 minutes after the application of the ligature. At the first inspection the veins were already full and the disc hazy; swelling of the disc became increasingly pronounced, but in the interest of asepsis was not measured. Microscopically the typical findings in papilloedema were observed; the oedema affected the nervous elements only, the ensheathing spaces not being distended.

Behr believes that this experiment establishes the circulation of parenchymatous juice towards the brain, for only thus could a ligature 2 cm. away from the papilla produce oedema in it. The experiment is held to show that excess of fluid in the vaginal spaces is only a secondary feature in papilloedema, having nothing whatever to do with its causation; constriction of the arteries and dilatation of the veins are likewise due to parenchymatous oedema and not to fluid in the ensheathing spaces.

ARNOLD SORSBY.

(3) **Goulden, Charles (London).—The clinical significance of slit-lamp appearances**. *Lancet*, August 16, August 23 and September 6, 1930.

(3) **Goulden's** three articles on the slit-lamp, in the *Lancet* series of articles on the Clinical Interpretation of Aids to Diagnosis, contain such an amount of information in condensed form that no abstract could do the work justice. There is a brief description of the instrument followed by a summary of the principal facts which have been revealed by it in connection with the conjunctiva, cornea, anterior chamber, iris, lens and vitreous.

ERNEST THOMSON.

(4) **Puscariu, Dr. Elena (Jassy).—Illustrations of orbito-ocular disease by means of casts. (Iconographie des maladies orbito-oculaires d'après moulages).** *Arch. d'Ophtal.*, September-October, 1930.

(4) For some years **Madame Puscariu** has had casts made of the region of the orbit and its surroundings in various diseased conditions. She has now published photographic reproductions of a series of these, 31 in number. These photographs are very life-like and suggest that the casts are even more so. For teaching purposes the casts are probably superior to drawings; at least that is the impression left by a study of the photos of them. They are worthy of notice by those engaged in teaching. A brief clinical description of each case is appended.

J. B. LAWFORD.

(5) **Tessier, Giulio (Venice).—The effects of the protracted instillation of atropine or pilocarpine into the conjunctival sacs of rabbits during the first year of life. (Influenza della Atropina e della Pilocarpina Instillate nel Sacco Congiuntivale del Coniglio in Modo Protratto e Fin dalla Nascita).** *Lett. Oftal.*, August, 1930.

(5) The effects of the prolonged use of mydriatics and miotics on the circulation of the normal eye and its tension, have never been thoroughly examined. When any of these drugs have been used for some periods, the occasion has always been some disease; in this experiment atropine in 0·5 per cent. solution and pilocarpine in 1·0 per cent. solution, were instilled daily into one eye of a rabbit, the second eye being left as control, for a period of 12 months. **Tessier** finds that atropine has no effect on the intra-ocular pressure, but that pilocarpine has a slight but definite effect of reduction. There is some evidence, as shown by the behaviour of Ehrlich's line, that atropine retards and pilocarpine hastens the circulation through the anterior chamber.

HAROLD GRIMSDALE.

(6) **Rauh, W. (Giesen).—Glaucosan in the treatment of glaucoma. (Zur Glaukombehandlung mit Glaukosan).** *Zeitschr. f. Augenheilk.*, Vol. LXXIII, p. 8, 1930.

(6) **Rauh** reports on 30 cases of primary glaucoma treated by means of glaucosan. The paper is illustrated by charts of six cases in which tonometric measurements were carried out twice daily for months. The author concludes that glaucosan has a place in the treatment of cases in which operation is refused, and that its use is confined to chronic simple glaucoma. The action of

glaucosan in lowering tension may at times persist for as long as 16 days, but it is never permanent, and eserine or pilocarpine must be constantly used. The reduction in tension by glaucosan in combination with eserine is not necessarily associated with prevention of further visual deterioration. Of the 30 cases treated, 20 ultimately, after weeks or months, needed operation; in the remaining ten it has made possible non-operative treatment for the time being, miotics together with adjuvant action of occasional glaucosan (in instillation or subconjunctival injection) keeping the tension under control and the vision from failing further.

In no case was permanent damage caused by acute glaucoma excited by glaucosan, such acute attacks yielding sufficiently to intravenous injection of 10 per cent. solution of sodium chloride, for operation to be carrried out satisfactorily. To obtain the minimal dilatation of the pupil when using glaucosan it is advisable to instil miotics into the eye several times during the hour before instillation of glaucosan. The first instillation of glaucosan should in any case be done in the in-patient department. When glaucosan in the form of drops has not enough effect, it should be injected subconjunctivally, and the treatment can be repeated daily until the desired reduction in tension is obtained. The author discounts the fear of glaucosan producing a persistent increase in tension after initial lowering; nor did he find a particular liability to recrudescence of acute glaucoma in cases which had had acute attacks previously. In cases of glaucoma in which one eye had gone on to the stage of absolute glaucoma, the tension can often be controlled in the better eye by glaucosan treatment of the blind one.

ARNOLD SORSBY.

(7) **Berens, Hardy and Stark (New York).—Divergence excess.** *Trans. Amer. Ophthal. Soc.*, Vol. XXVII, p. 263, 1929.

(7) **Berens, Hardy** and **Stark** define divergence excess as follows:—"That ocular muscle imbalance exhibiting an exophoria more marked when the gaze is directed into the distance than when it is adjusted for near vision, combined with normal prism convergence and near point of convergence, an excessive ability to overcome diplopia caused by prisms placed base in before the eyes. The lateral movements of each eye should be normal and concomitant."

The incidence is 1 to 2 per cent., and it is usually associated with hypermetropia. The treatment is divided into (1) Orthoptic exercises and (2) Operative measures such as recession and tenotomy.

The orthoptic exercises should be tried and persevered with.

The authors state that satisfactory results were obtained in 75 per cent. of cases, and that the patients who underwent this treatment were followed up for from two months to eight years. In young persons the use of negative spheres stimulates accommodation. Hypermetropes were improved by treatment and myopes cured. The results justify a trial of this form of treatment.

H. B. STALLARD.

BOOK NOTICES

Ophthalmo- und Oto-Neurologie. By E. A. SPIEGEL, Professor of Neurology in the Temple University, Philadelphia (U.S.A.), and IGNAZ SOMMER, Assistant in the Ear, Nose and Throat Department of the Vienna Polyclinic. With 87 figures. Pp. 336. Berlin: Julius Springer. 1931. Price, 28 R.M.

This is a very useful and clearly written book on the neurological aspects and relationships of ophthalmology and otology—more than half being devoted to the former subject. The introductory chapter on the brain stem and cerebrum is an excellent review of the anatomy and functions of these parts, and whilst the student ought to know all about most of it before embarking upon his special subject, a concise review of this kind is fully justified. Subsequent chapters deal with the cerebrospinal fluid, the visual paths, the fundus oculi, eye movements, the smooth muscles of the eye and orbit, and the sensory nerve supply of the eye. In these chapters too much space is wasted over the commonplaces of the ordinary ophthalmic textbook. For example, quite inadequate notes on tuberculous choroiditis (8 lines), diabetic retinitis (7 lines), and so on are useless, quite apart from their remote relationship to neurology. In the section on retrobulbar neuritis there is no reference to tobacco.

Ophthalmologists will be less concerned with the second part of the book, but the physiology of the labyrinth and the neurology of posture, etc., are so fascinating that their study supplies its own reward. Moreover, there is much about nystagmus which will well repay the ophthalmologist's perusal.

The book is excellently printed and illustrated.

Das Glaucom. By A. PETERS, Professor in Rostock. With 35 figures. Pp. 361. Berlin: Julius Springer. Price, 38 R.M.

This is a part of the third edition of the *Graefe-Saemisch Handbuch der gesamten Augenheilkunde*. It is not, as the title might lead one to suppose, a comprehensive treatise on glaucoma.

As the author states in his preface, operative treatment has been dealt with in the *Handbuch* by Köllner, Heine, and von Wessely; the pathological anatomy and histology have been described by A. Elschnig in the pathological treatise of Henke - Lubarsch. Further, the work is to be regarded as complementary to Schmidt-Rimpler's article in the second edition of the *Graefe-Saemisch Handbuch*. The book, therefore, as the author says, has somewhat the character of a torso. The literature is reviewed from 1908 to 1930, thus again forming an addendum to Schmidt-Rimpler's article.

In spite of these limitations most of the important facts and theories of glaucoma are reviewed, and an account is given of recent work on the physiology of the secretion of the intra-ocular fluid and intra-ocular pressure. The literature is, indeed, exhaustively treated; but there is little critical analysis, and the reader is allowed to draw his own conclusions from a mass of conflicting results and statements.

As an extensive bibliography the book will be useful. As an excerpt from a *Handbuch* or Text Book in the English sense of the term it is thoroughly misleading. But it is obvious that the old and revered "Graefe-Saemisch" has long ceased to be a well proportioned entity.

An Introduction to the Literature of Vertebrate Zoology. Based chiefly on the titles in the Blacker Library of Zoology, the Emma Shearer Wood Library of Ornithology, the Bibliotheca Osleriana (the Gest Library of Chinese Literature), and other Libraries of McGill University, Montreal, Canada. Compiled and edited by CASEY A. WOOD, M.D., LL.D., Collaborator, Division of Birds, Smithsonian Institution. 4to, pp. xix + 643. Coloured frontispiece. London: Oxford University Press. 1931. Price, fifteen dollars, or three guineas.

The contributions of medical men to general scientific literature, as apart from purely medical or surgical work, are very numerous and it is acknowledged that a considerable number of them possess high merit. Many of the smaller contributions have been made by men engaged in busy practice, and of the larger by those who have left the battleground of ordinary professional life. The ophthalmic branch of the medical profession has had its share in this useful work, but the present volume will add fresh lustre to the fame of our ophthalmic confrère, Dr. Casey A. Wood. His well-known Encyclopaedia of Ophthalmology and his epoch-making treatise on the Fundus Oculi of Birds have already made him a heavy creditor to ophthalmic surgeons, and the present work will extend the indebtedness to a far wider range of zoologists.

In these days there is a veritable cataract of literature, periodical and otherwise, in many languages, and the highest possible praise must be given to those ardent workers who put together in one volume such a mass of information on the literature of a subject as indicates an amazing industry, guided by their own bitter experience, due to the absence in available form of just the type of information now made available. It is quite clearly the work of an expert, not only in zoology but in library methods and needs.

The treatise is divided into three main sections. The first section consists of introductory matter furnishing a brief account of the literature of Vertebrate Zoology from the earliest times to the present. General treatises, numerous periodicals and serials, monographs on various of the special branches likely to interest the advanced student and the librarian are included, while brief descriptions are given of Natural History Societies, Museums, and Zoological Stations, throughout the world; of travelogues of Naturalists, Drawings by Animal Painters and Illustrators. In its 147 pages it contains an enormous amount of quaint, fascinating and highly interesting historical information, with innumerable data about men and books as well as about zoology. This section alone demonstrates an astonishing breadth of reading and an amount of critical acumen which show that the compilation of this section has been the work of a pure enthusiast, a labour of love indeed.

The second section is an arrangement of Library Contents in both chronological and geographical order, and its 26 double-column pages will have special appeal to librarians.

The third section is the largest and most valuable for the research student and the librarian, it is a partially annotated catologue of the Vertebrate Zoological items in the various libraries of McGill University, Montreal, as given at the head of this article. As these libraries contain a very large selection of important works, both ancient and modern, on Vertebrate Zoology, approaching in numbers about 400,000 volumes, it will be readily appreciated that the scope of this work is very considerable even in such a vast subject. It will not be long before the merits of this work are appraised by those whose continuous and daily use of it will best entitle them to speak, but it is quite obvious to anyone accustomed to hunt for references that it is bound to provide an enormous saving in time and energy for all workers in that field. These details are culled from many languages and are comprehensively annotated with just the sort of notes that help the investigator to evaluate the work concerned.

The absence of the *British Journal of Ophthalmology* from the list has led to the omission of at least one original, if somewhat highly specialized, contribution to comparative ophthalmology, which may thus be lost to zoology, if not to ophthalmic literature. Random tests of the index on Polar matters indicate the far-spread

nature of the net, and the notice of Dr. Edward Adrian Wilson, who shared Captain Scott's triumph and his fate, reminds us of one very brilliant medical zoologist and artist, whose loss we all deeply deplore.

On page 139 Sir Joseph Banks's voyage to Iceland should be dated 1772, not 1722.

Although no pretence is made to absolute completeness, the absence of several well-known and widely used books on embryology and on biology should stimulate the respective authors and publishers to send copies to the McGill Libraries so that their work may be better known in Canada and the United States.

The paper is dull in surface, sufficiently thick to be comfortable to handle and to prevent the type from showing through, whilst the use of a variety of pleasing founts of type gives a favourable impression of the acceptance to be accorded to what must be considered one of the most elaborate and comprehensive treatises on the literature of any scientific subject. This handsome volume will be much used by research workers in zoological libraries everywhere and will, if such were needed, be for a long time a worthy monument to the industry and scholarship of Dr. Casey A. Wood, to whom the hearty congratulations of his many ophthalmic friends and admirers on both sides of the Atlantic are sure to be freely given.

The Experimental Study of Reading. By M. D. VERNON, M.A. 8vo. pp. xiii + 190. Cambridge: at the University Press. 1931. Price, 8/6.

It will be remembered that Miss Vernon contributed two papers on the eye movements in reading to this journal in the year 1928. But eye movements form a part only of the whole, for there is a very large psychological element involved as well. In this valuable book she deals fully with both sides of this question, giving a clear account of recent experimental work which bears on the psychology of reading. The acquirement in reading of a specially adapted series of eye movements is described; the visual perception of adults in reading and their relation to perception in general are considered, as well as the development of reading in children and disabilities in functioning. Lastly, such matters as paper, type and setting are considered.

It is to feared that the book will appeal more to the philosopher than to the casual reader, but all the same its value cannot be denied. At first sight the matter may seem not worth worrying about; one reads, one knows that one reads, but does not bother to consider how one does it. "Use is second nature," as Mr. Pecksniff declared, and this is certainly a fundamental truth when applied to reading.

Whatever arguments may be adduced in favour of phonetic spelling, all in this country will agree with Miss Vernon in condemning a practice which deprives a word of its etymological factor and thereby takes half the interest from the word. In such a hotch potch as the English language where words are derived from many sources we should certainly insist, even at the risk of being thought pedantic, on maintaining the etymological spelling.

With no wish to be thought facetious one merely casts one's mind back to one's own childhood to visualize some of the problems concerned; and at once one is confronted with the difficulty that the more recondite type of juvenile literature was usually read out loud by one's elders. We made the acquaintance of Lemuel Gulliver in an expurgated edition fit for children and have no recollection of his Yahoos and Houyhnhnms.

Lewis Carroll and Charles Kingsley each use on occasions words which can only be described as "curiouser and curiouser." It would, we think, be a good test to set a child to read the rat-tail page in "Alice in Wonderland," where the type ranges from No. 10 (pica) at the top to something smaller than No. 1 (diamond) at the bottom. At a slightly more advanced age we might try "Jabberwocky" in "Through the Looking Glass," and set the rising scholar "galumphing" through it. Kingsley's "The other-end-of-nowhere" is made perfectly easy by the words being hyphened, but why is it that "Mrs. Doasyouwouldbedoneby" is more easily appreciated by one's brain than "Mrs. Bedonebyasyoudid"?

NOTES

Annual Congress of the Ophthalmological Society of the United Kingdom, at Edinburgh

Provisional Programme: THURSDAY, MAY 12, 10 a.m.—12.30 p.m. Opening address by the President, and papers. 2.30 p.m., at the Royal Infirmary. Clinical cases. 4 p.m. Tea and discussion of cases afterwards. Evening. Annual dinner, probably to be held in the College of Surgeons.

FRIDAY, MAY 13, 9.30 a.m.—12.30 p.m. Discussion on senile cataract, pre-operative, and post-operative complications and management. 2.30—4.0 p.m. Papers. 5 p.m. Bowman Lecture by Professor van der Hoeve. 8.45 p.m., Papers.

SATURDAY, MAY 14, 9.30 a.m.—12 noon. Papers. 12 noon. Annual Meeting of the Society. 12.30 p.m. Report of the Council of British Ophthalmologists.

Voluntary Hospitals Ophthalmic Clinics

WE have received the following from the Secretary of the Voluntary Hospitals Ophthalmic Clinics.

The Joint Committee of the V.H.O.C. scheme recently had under consideration the question of ways and means by which hospitals co-operating in the scheme could be reimbursed for expenses incurred in the administration of the special clinics. While the scheme leaves the governing bodies of individual hospitals to evolve a satisfactory method to cover expenses, the Joint Committee is desirous that it should be known that it is strongly of opinion that no deduction should be made from the Surgeon's fee of 10/6.

As a concession to the possible difficulties of covering the expenses incurred the Committee is prepared to approve a deduction of 6d. per case from the Surgeon's fee, but should any hospital reduce the fee below 10/- the Committee is anxious that it should be known that such an arrangement is entirely at variance with its wishes. It is felt that every effort should be made by the hospitals concerned to retain intact the fee in question.

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Diet Deficiency and Trachoma

Dr. LOCKHART GIBSON, of Brisbane, sends us a cutting from the *Medical Journal of Australia* for October 10, 1931, containing a letter of his on trachoma and diet.

His experience is that trachoma is not so highly contagious as some think. "At Lemnos . . . none of our troops or hospital patients acquired trachoma. In Egypt the same obtained. I saw no case of trachoma among troops at Lemnos nor at Abbassia who had not suffered from trachoma prior to enlistment."

He did not find, during his connexion with the Brisbane Hospital for Sick Children, that contamination of other children occurred, in spite of the fact that the eye wards usually contained severe cases of trachoma which were not isolated. Dr. Lockhart Gibson agrees with Sir James Barrett in postulating "a contributing agent, a 'missing factor,' other than or in addition to contagion." He would suggest that trachoma is largely or primarily a food deficiency disease, due to lack of vitamin A.

This letter is too long to lend itself to further abstraction and it should be read in the original.

Dr. Lockhart Gibson asks us to notice his views in this journal; and we gladly devote a note for the purpose. We do not know whether the question of diet in Egypt and Palestine, the homes of trachoma, has been studied experimentally; it should not present insuperable difficulties.

North of England Ophthalmological Society

DR. A. MAGITOT, of Paris, will give a series of lectures under the auspices of the North of England Ophthalmological Society on January 8, 11 and 12, 1932. On January 8, Dr. Magitot's address will be given at Manchester, on "Pathological Tension of the Eye." On January 11, the address will be given at Leeds, on "Tonoscopy, Testing the Blood Pressure in the Retinal Arteries." On January 12, the lecture will be given at Sheffield on "The Development of the Human Eye," (illustrated by coloured autochrome plates). The time arranged for these lectures is 4.30 p.m.; the venue will be added to the table of Future Arrangements. The lectures will be given in English.

FUTURE ARRANGEMENTS

1932

January 8.—Section of Ophthalmology, Royal Society of Medicine.

January 8.—North of England Ophthalmological Society, Dr. Magitot, at Manchester (The Royal Infirmary).

January 11.—North of England Ophthalmological Society, Dr. Magitot, at Leeds (The General Infirmary).

January 12.—North of England Ophthalmological Society, Dr. Magitot, at Sheffield (The University).

February 5.—North of England Ophthalmological Society, at Newcastle-on-Tyne.

February 12.—Section of Ophthalmology, Royal Society of Medicine.

March 4.—North of England Ophthalmological Society, at Liverpool.

March 11.—Section of Ophthalmology, Royal Society of Medicine. (Clinical Meeting).

April 8.—North of England Ophthalmological Society, at Sheffield.

May 12-14.—Annual Congress of the Ophthalmological Society of the United Kingdom, at Edinburgh.

June 10.—Section of Ophthalmology, Royal Society of Medicine. (Annual Meeting).

CONTEMPORARY OPHTHALMIC LITERATURE

American Journal of Ophthalmology. *November, 1931.*

GRADLE. Concerning cyclodialysis in simple glaucoma.
THYGESON. Bacterial flora in Egyptian trachoma.
KRONFELD. Cyanosis retinae.
KREUTZ. Bilateral hole at the macula.
WENTWORTH. Variations in the normal blind spot with special reference to the formation of a diagnostic scale.
O'BRIEN. Elements of safety in cataract extraction.
DUNNINGTON. Hyperphoria, its etiology, diagnosis and treatment.
AGATSTON. A simplified method of muscle resection for squint.
JASON and ABRAHAM. Christian's syndrome.

Annales d'Oculistique. *October, 1931.*

MAGITOT. Normal and hypertensive reactions after compression of the globe.
CHARLIN. The masked nasal nerve syndrome.
SÉDAN, ASTIER, and CAUDIÈRE. On the radio-therapy of a lympho-sarcoma and a lymphoblastoma of the orbit.
COMÈS. The period of family contamination by trachoma in Hué (Annam).
——— Trial auto-haemotherapy (sub-conjunctival).

Archives d'Ophtalmologie. *November, 1931.*

CUÉNOD and NATAF. Biomicroscopy of early trachomatous pannus.
MICHAIL. Cholesteatoma of the orbit.
PUSCARIÚ. Statistical researches into ocular syphilis.
FRANÇOIS. Neuritis of the nasal nerve.

Archiv für Ophthalmologie. *October, 1931.*

LINDNER. Observations on the occurrence and treatment of idiopathic and traumatic retinal detachment.
METZGER. Experimental investigations on the light tone in man and the rabbit.
SONDERMANN. Observations on our knowledge of the mechanism of development of the human eye in the first months of foetal life.
BARTELS. Observations on the study of nystagmus.
OHM. On nystagmus.
LOBECK. On the question of pneumococcal infection of the eye.
ROSEIN. On the question of the pathological anatomy of the eye in *Commotio retinae* (Berlini).
SCHMELZER. Nervocidin in ophthalmology.
BLATT. On the unitary and dualistic theory of treatment of trachoma in present day practice, in statistics of trachoma and in prophylaxis.
HEINSIUS. On minimal choroidal sarcoma.
SCHLÄPFER. On Goldmann's reply to the experiments on infra-red cataract in *Graefe's Archiv*, Vol. CXXVI, p. 652.

Annali di Ottalmologia e Clinica Oculistica. *July, 1931.*

MAGGIORE. The optical foundation of skiascopy (*continuation and end*).
ADDARIO. The mechanico-vaccinal therapy of trachoma and of its corneal complications (in the light of new anatomical, bacteriological and clinical criteria), with 45 clinical histories.
STILO. Contribution to the microphysical structure of the rods.

NICOLETTI. Gonin's operation for detachment.
D'AMICO. On the surgical cure of trachomatous pannus.
CUCCHIA. The influence of astigmatism of oblique axis on the visual acuity of the peripheral retina.

Bollettino d'Oculistica. *October, 1931.*

ACCARDI and FONTANA. On the reticulo-endothelial system of the eye.
PALMERINI. On hyperglycaemia without glycosuria in advanced diabetics with ocular affections.
DEL DUCA. The corneal epithelium in the vertebrates.
GALLENGA. Blood cholesterin content and intra-ocular tension with particular regard to glaucoma.
MORETTI. Homologous grafts of spindle-celled sarcoma.
LAMPIS. Cavernous angioma of the orbit.

Lettura Oftalmologica. *September, 1931.*

MONTANELLI. Granuloma of the inferior conjunctival fornix.
D'AMICO. Considerations on a case of sudden bilateral blindness during the treatment of Kala azar with antimony tartrate.
MANZUTTO. Concerning Dr. Koch's case of a thorn penetrating the vitreous through the sclera.

October, 1931.

MONTANELLI. Tuberculous granuloma of the lids.
AGNELLO. Contribution to the study of traumatic glaucoma.

Archivos de Oftalmologia Hispano-Americanos.

November, 1931.

ORTIN. On the use and biology of grafts (plastias).
ZAVALIA and BRANDAN. On the changes observed in the ophthalmoscopic picture of the arterio-venous crossings as a sign of early arterio-sclerosis.
AMAT. A late and serious complication of dacryocystorhinostomy.

Boletin de Informacion Oftalmologica. *September-October, 1931.*

MANES. Pathological relations between ophthalmology and odontology.
DAMEL. Amblyopia and simulated mydriasis (medico-legal).
LANDO. Clinical cases of the traumatic syndrome of the anterior segment.
VENTOLA and DAMEL. Coloboma of the macula.

Revista Oto-Neuro-Oftalmologica. *November, 1931.*

PAVIA. Retinography in colours. First experiments with direct autochrome colour photography of the fundus.
MONIZ. The localisation of cerebral tumours by arterial encephalography.
BAILLIART. The movements of the needle of the tonometer.

December, 1931.

AUSTREGESILO. Clinical decerebrate rigidity.
ALBERNAZ. Positional cephalic nystagmus.
PAVIA. New arrangement for examination of the fundus by red-free light.